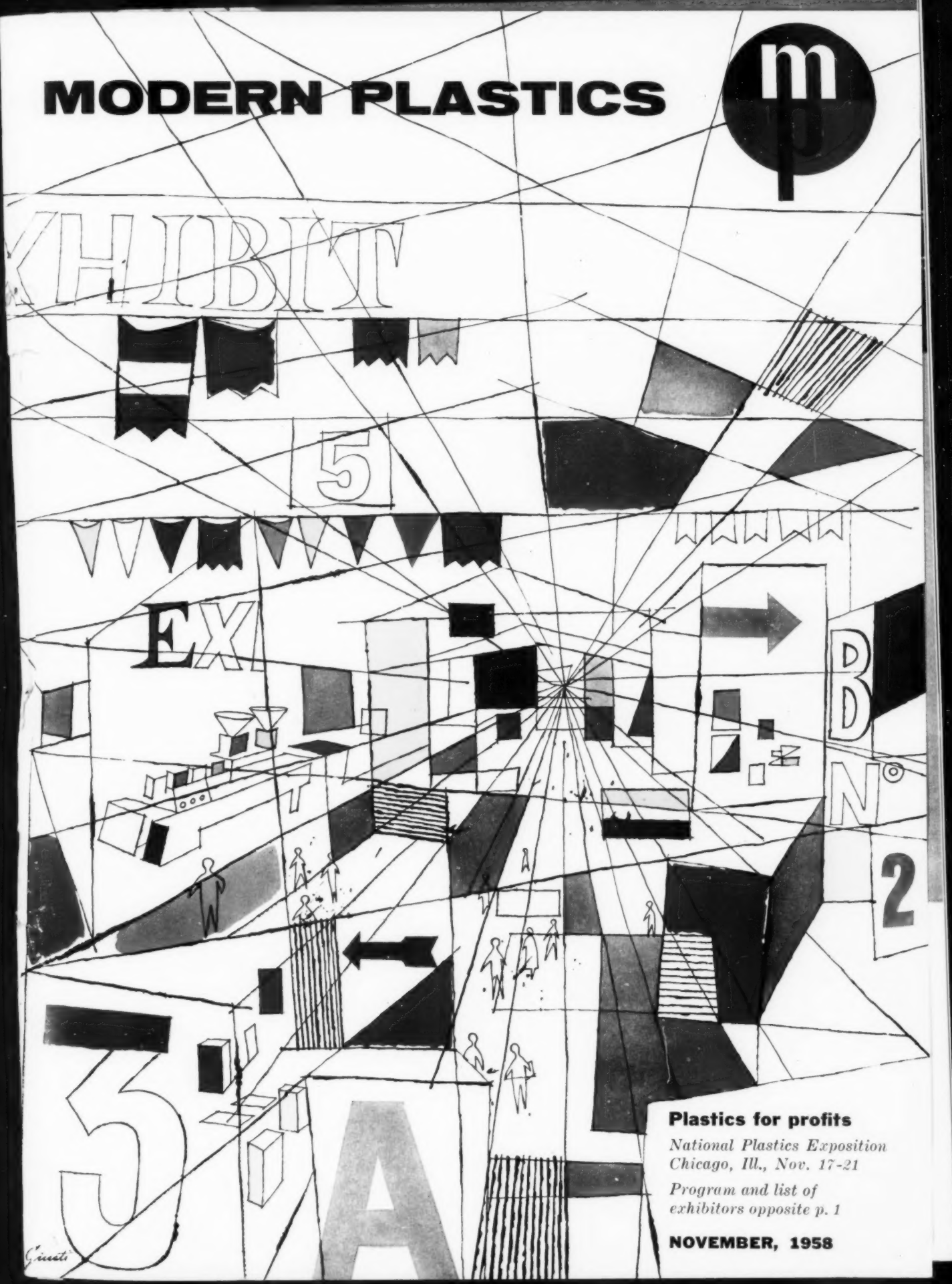
MODERN PLASTICS



Plastics for profits

National Plastics Exposition
Chicago, Ill., Nov. 17-21

Program and list of exhibitors opposite p. 1

NOVEMBER, 1958

FIRST FIRE-RESISTANT FIBROUS-GLASS RUNABOUT, *La Sirena* by Feather Craft is a trend-setter in pleasure boating. Hetron hull and deck, pressure-molded by Universal Moulded Products Corp., are self-extinguishing.

How to start a fire under your competition

You can't see it, but there's something different about this plastic boat. It resists fire.

The hull is molded of fibrous glass and Hetron® polyester resin. Hetron-based hulls come through firebrand tests—tests that destroy conventional plastic hulls—with only slight localized charring and no loss of seaworthiness.

Reason: Hetron is permanently self-extinguishing. It has a flame spread lower than wood; far lower than conventional unfilled polyesters. You don't have to add anything to Hetron to make it resist flame. It's just *naturally* safe.

Structural strength over large surface areas is another Hetron plus. It can be processed like any polyester—by hand layup, by matched metal die molding, or like the hull illustrated here, by a special autoclave process.

Fire-retardant boat hulls are but one example of the many current uses of Hetron. Others include 55-foot radomes, flat and corrugated laminated sheets for glazing and roofing, corrosion-resistant duct work, aircraft parts, and a variety of molded industrial parts.

Could Hetron be your cue to a better product? Many manufacturers are entering new markets, or outstepping competition in established markets, with this stronger, safer polyester. No other resin gives you more for your molding dollar—in safety, strength, smooth surface, structural stability.

Where can Hetron help you? For details on the resin, and names of fabricators who can make Hetron shapes for you, write us today.

Hetron is a product of

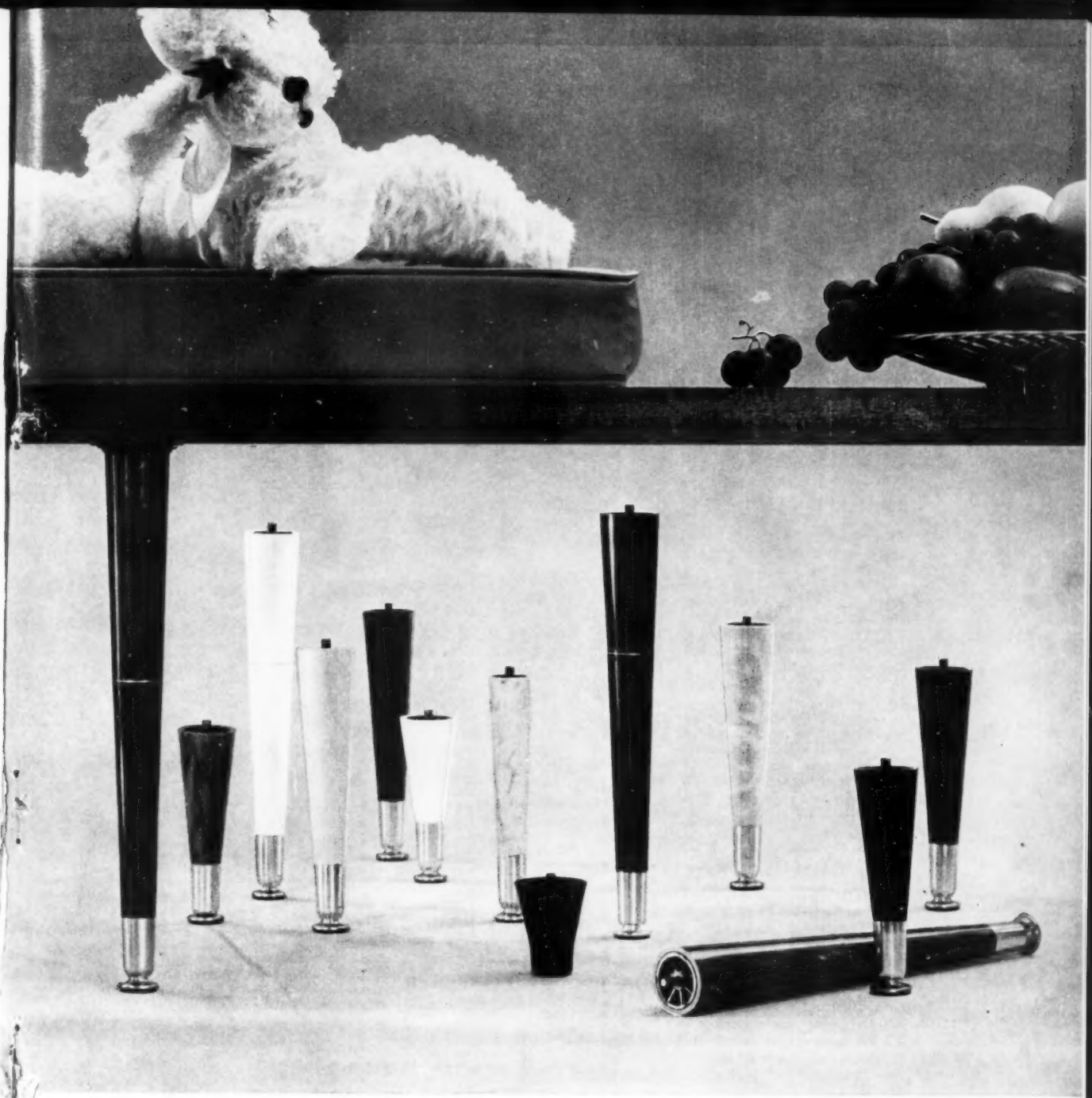
DUREZ HOOKER CHEMICALS PLASTICS

PLASTICS DIVISION

HOOKER CHEMICAL CORPORATION

1211 Walck Road, North Tonawanda, N. Y.

Booths 201, 203 and 205 at the Plastics Industries Exposition



Catalin High-Impact STYRENE puts furniture on a better footing

Alert manufacturers like Delta* know that product design starts *from the ground up*. Hence, as the basic material for molding their new plastic legs, with twist-locking features, they chose CATALIN High Impact STYRENE—sturdy and resistant to marring from handling or from spilled liquids—in a choice of handsome wood grains or solid colors. Equipped with brass ferrules, swivel or plain, these rugged supports, in lengths from 3" to 15", quickly and inexpensively give an attractive coffee table or many another article of furniture a welcome lift.

Planning *from the ground up* should include a careful examination of the merits of *Catalin Polystyrene*, in impact or heat-resistant grades; *Catalin Polyethylene*, in the widest range of densities and melt indexes; and *Catalin Nylon*, in extrusion, injection or blow molding grades—these give you an unsurpassed selection of plastic formulations among which to seek the one best suited to put your production on a better footing—to improve your product or to reduce its production costs—or both! Inquiries invited.

*The plastic legs shown are molded by Hauser Products, Inc. for Delta Precision Products, Inc., both of Chicago 41, Ill.

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE • NEW YORK 16, N. Y.

Catalin

In addition to Styrene, Polyethylene and Nylon Molding Compounds, Catalin chemical products include a wide range of Urea, Phenolic, Cresylic, Resorcinol and Melamine Resin formulations

MODERN PLASTICS*

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November
1958
Number 3

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Another new development using

B.F.Goodrich Chemical *raw materials*

Gold Seal Forecast® flooring *is made by Congoleum-Nairn, Inc., Kearny, New Jersey, using rotogravure to print patterns with vinyl inks on a vinyl coated flooring, which is then sealed with a fused-on coating of Geon. B.F.Goodrich Chemical Company supplies the Geon polyvinyl materials.*

GEON seals in beauty, makes new low-priced flooring really foot-proof

PATTERN and color of this new low-priced flooring are permanently sealed in—and dirt and wear are sealed out—with Geon polyvinyl material. Feet never touch the flooring's beauty. Instead, you walk on a long-lasting, mirror-bright surface that stays smooth and offers easier care advantages than many of the most expensive floorings.

Geon makes this flooring waterproof and stainproof. It repels dirt, grease, grime and alkalies. Even Mercurochrome won't cause a problem—it wipes right off. Installation is easy, too. No tacks, no adhesive. Just lay it on the floor.

In your application, selecting the right Geon polyvinyl material can be the first step toward a dramatic new or improved product. For information, write Dept. LE-11, B.F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B.F.Goodrich Chemical Company
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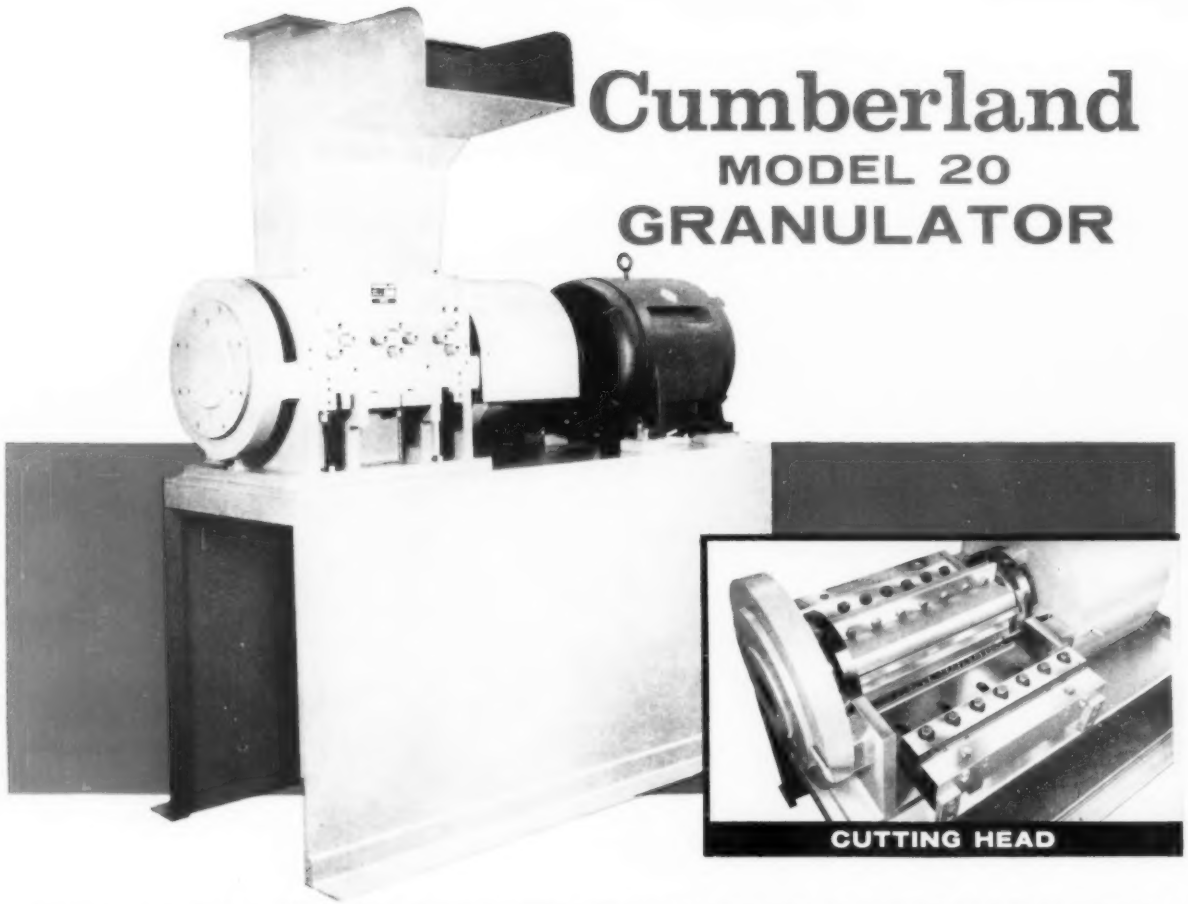
SEE US AT BOOTH NO. 509
8TH NATIONAL
PLASTICS EXPOSITION
NOV. 17-21
INT'L AMPHITHEATRE - CHICAGO

B.F.Goodrich

GEON polyvinyl materials • HYCAR American rubber and latex
GOOD-RITE chemicals and plasticizers • HARMON colors

Cumberland
MODEL 20
GRANULATOR



PART OF THE COMPLETE LINE OF CUMBERLAND PELLETIZERS, BESIDE THE PRESS AND CENTRAL GRANULATING MACHINES, DICERS, CHOPPERS AND PRE-BREAKERS

LARGE THROAT OPENINGS – 9" x 20"
– 12¾" x 20"

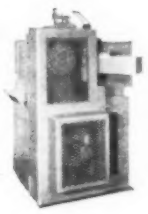
SUPERB CONSTRUCTION – heavy steel weldments with deep welds. Rotor and seal rings are heat treated to provide tough undamageable parts, and ground all over to achieve extreme dimensional accuracy and balance.

VERSATILITY – handles chunky parts of toughest plastic materials such as bleeder scrap, cylinder purgings and heavy slabs of thermoplastic materials. Special adaptors for handling long lengths of pipe such as kralastic, high impact vinyl and polyethylene.

Watch future ads featuring other outstanding Cumberland machines and write for Bulletin 260

STAIR STEP DICER

Perfect cubes or pellets 1/16" to 1". Two standard sizes accommodate up to 7" and up to 14" ribbons.



BESIDE THE PRESS GRANULATOR

Two new models. Throat sizes available:
8½" x 12"
12" x 16"
10" x 10"
6" x 10"
6½" x 8"

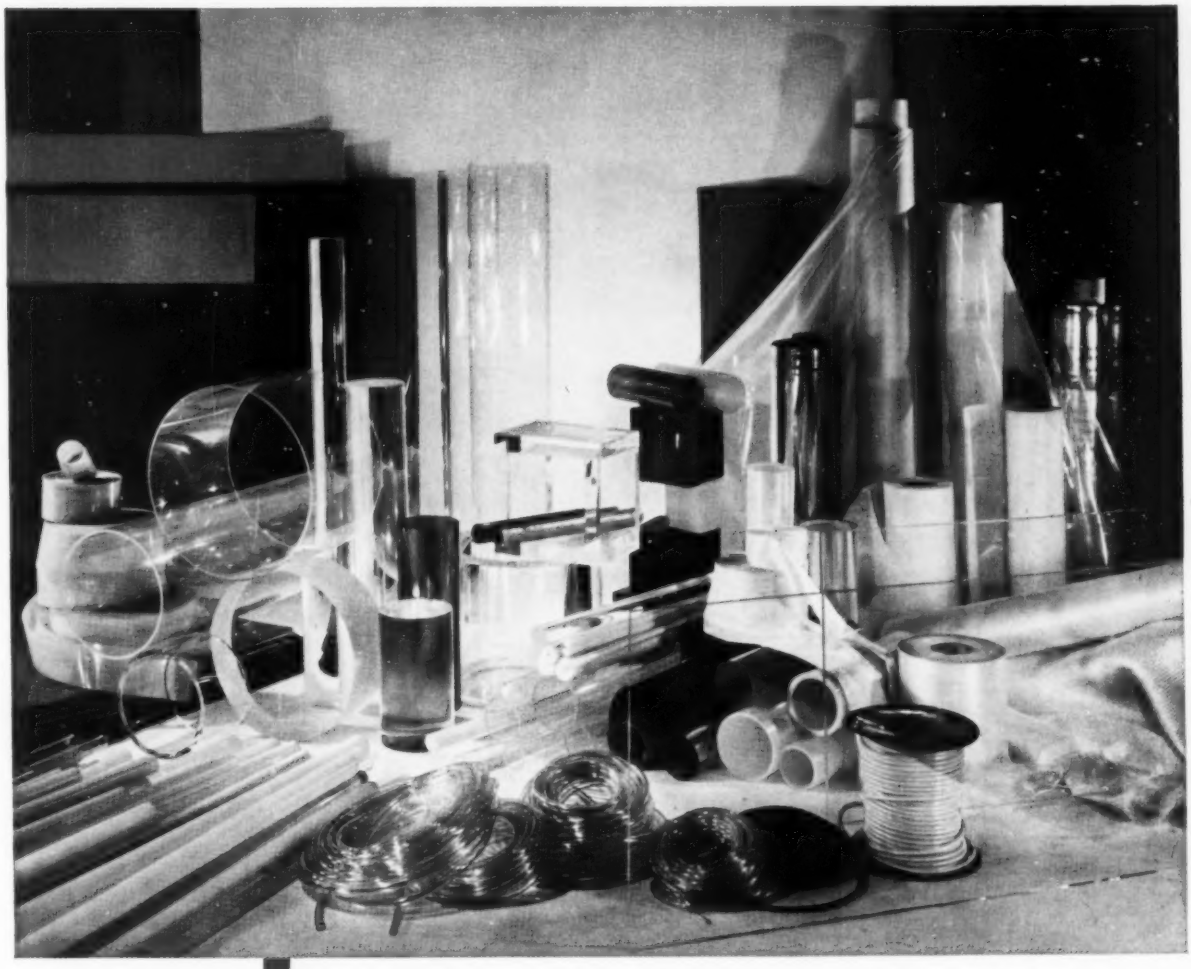
Cumberland
ENGINEERING COMPANY, INC.

DEPT. 1 • BOX 216, PROVIDENCE, RHODE ISLAND
California Representative: West Coast Plastics Distributors, Inc.
8510 Warner Drive, Culver City, Calif.

FOREIGN LICENSEE — Burtonwood Engineering Company, Ltd., Burtonwood, Warrington, Lancashire, England—Sole Manufacturers and Distributors outside North and South America.

317-7

CADILLAC HAS EVERYTHING IN PLASTIC



RODS
SHEETS
TUBES

AMERICA'S LARGEST PLASTIC STOCKS

PLEXIGLAS® · VINYLITE® · NYLON · ACETATE · STYRENE · MYLAR®
POLYETHYLENE · PHENOLICS · TEFLON® · KEL-F · FIBERGLAS® · ACRYLIC

We can supply anything in clear and colored plastic material.

Fully stocked warehouses within overnight shipping distance from every major U. S. city.

Cadillac's experienced engineering staff is geared to help you determine the plastic materials you need.

OUR CADCO BRAND

Cadillac mass-produces a wide variety of "Cadco" cast acrylic rods, tubes, block and extruded sheet. Available optically clear and in a wide variety of colors.

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10 WAREHOUSES TO SERVE YOU

WRITE FOR FREE BOOKLETS . . .

Cadillac Plastic and Chemical Co.

Gentlemen: Please send me the following booklets:

- ☐ How to work with Plexiglas
- ☐ 157 Ways to use Plastics for maintenance
- ☐ Fiberglas catalog and prices
- ☐ General catalog and prices
- ☐ Fabrication data of "Cadco" Extruded sheets

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Address_____ City_____

Company_____

PLEXIGLAS
POLYSTYRENE
ACETATE BUTYRATE
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prompt

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We carry
these plastics in stock...
for all your immediate needs!
Available in all gauges,
finishes and colors.

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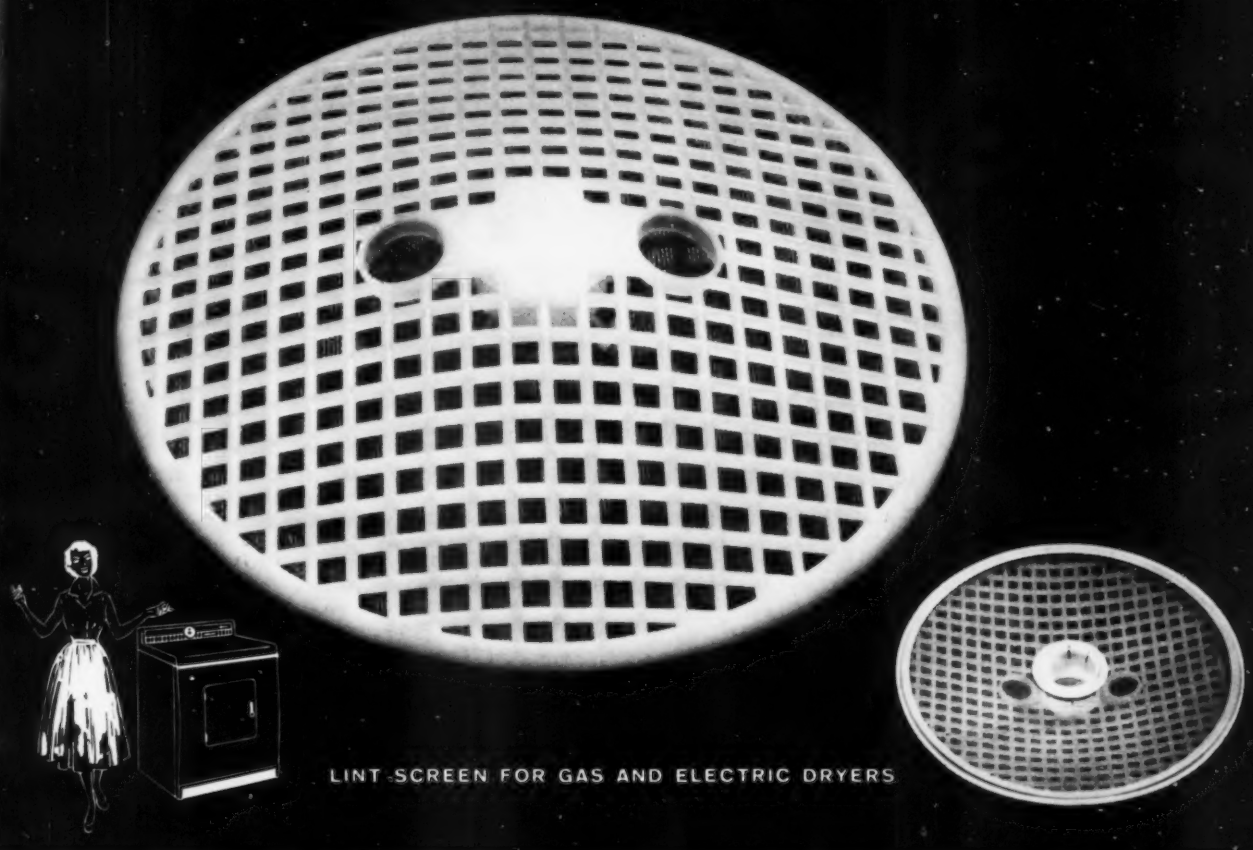
Southwest Division: 1201 Levee Street • RIverside 1-3415 • Dallas 7, Texas

DESIGNED IN CELANESE FORTIFLEX...



MOLDED IN CELANESE FORTIFLEX BY THE GENERAL INDUSTRIES COMPANY, INC., ELYRIA, OHIO

Maytag Lint Screen has new toughness, heat-resistance . . . in Fortiflex

When Maytag required a material for the lint screen in their new gas and electric dryers, they sought one that would give them new rigidity and toughness, more heat-resistance . . . and they found it in Fortiflex. The high temperature-resistance of this high-density, linear polyolefin plastic extends to sterilization levels. Fortiflex is five times more rigid than conventional polyethylenes, and it has the necessary smooth, lustrous surface to handle laundry gently.

Fortiflex "A" is presently available in four melt indexes developed to accommodate a wide range of conditions and applications of interest to designers and manufacturers. For more information and/or test quantities, just use the handy coupon.

Celanese® Fortiflex®

TYPICAL PHYSICAL AND CHEMICAL PROPERTIES OF FORTIFLEX

Properties of Fortiflex "A" Related to Melt Index

PHYSICAL PROPERTIES	ASTM METHOD	UNITS	FORTIFLEX RESINS A-20	A-70	A-250	A-500
Melt Index	D-1238-52T	—	0.2	0.7	2.5	5.0
Heat Distortion Temp. (66 psi)	D-648-45T	°F.	185	185	180	180
Brittleness Temp.	D-764-52T	°F.	—200	—180	—160	—100
Impact Strength, izod (⅛" x ½" injection-molded bars)	D-256-54T	ft. lb./in. notch	23	18	13	3
Tensile Strength, Max., 0.2 in./min.	D-638-52T	psi.	3700	3600	3500	3300
Elongation, First Tensile Yield Point	D-638-52T	%	25	25	25	25

Properties of Fortiflex "A" Not Affected by Melt Index

PHYSICAL PROPERTIES	ASTM METHOD	UNITS	VALUE
Density		g/cc.	0.96
Refractive Index	D-542-50	$N^{23}D$	1.54
Hardness, Shore D	D-676-49T		65
Stiffness	D-747-50	psi.	150,000
Water Absorption (⅛" specimen, 24 hrs. immersion @ room temp.)	D-570-54T	%, wgt. gain	<0.01
Flammability	D-635-44	in./min.	1.0
*Mold Shrinkage, length		in./in.	0.03 to 0.05
width		in./in.	0.02 to 0.04

*Measured on injection molded tensile bar. Mold shrinkage depends on part design and molding conditions.

Fortiflex...a Celanese plastic

Canadian Affiliate: Canadian Chemical Co., Limited, Montreal, Toronto, Vancouver.
Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, N. Y. 16

Celanese Corporation of America, Plastics Division,
Dept. 101-K, 744 Broad Street, Newark 2, N. J.

Please send: ☐ more information on, ☐ test quantities of Fortiflex.

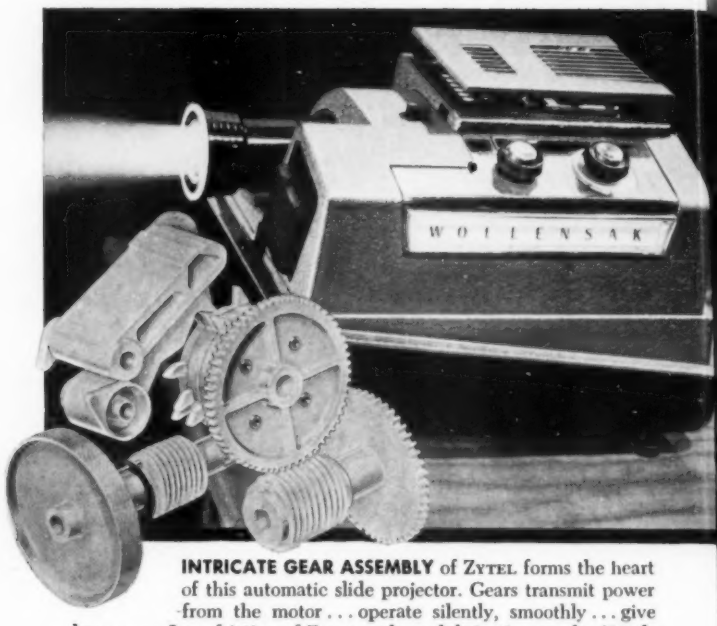
Name _____ Title _____

Company _____

Address _____

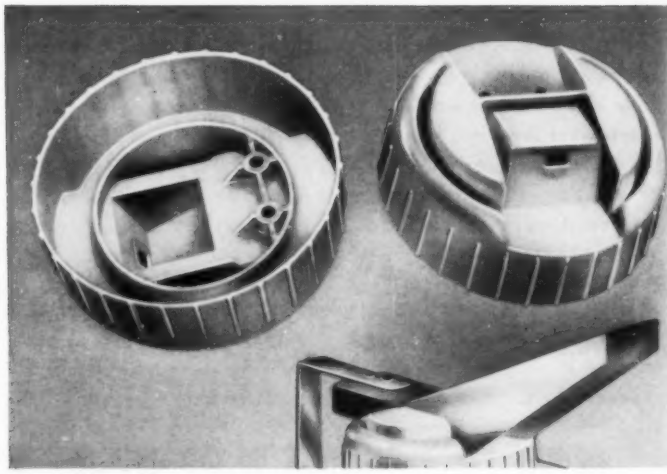
City _____ State _____

BLOCKS molded of ZYTEL require little or no lubrication. Shells and sheaves of ZYTEL are up to 69% lighter than those made with conventional materials . . . and they never corrode. (Molded for Boston & Lockport Block Co., Inc., East Boston, Massachusetts, by Danielson Manufacturing Co., Danielson, Connecticut.)



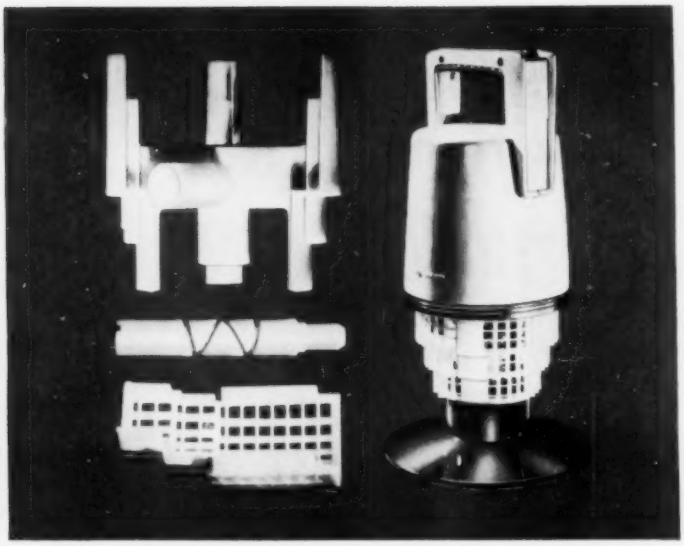
INTRICATE GEAR ASSEMBLY of ZYTEL forms the heart of this automatic slide projector. Gears transmit power from the motor . . . operate silently, smoothly . . . give long wear. Low friction of ZYTEL reduces lubrication needs. (Made by Wollensak Optical Co., Chicago, Illinois; parts molded by Thorgren Tool and Molding Co., Inc., Valparaiso, Indiana.)

5 more examples showing how new



VAPORIZER CAP withstands intermittent contact with boiling water and steam. High strength of Du Pont ZYTEL permits design of cap for uniform wall thickness . . . saves material. Cap resists abrasion and impact . . . can be molded in attractive colors. ZYTEL is unaffected by medicinal substances in the vapor. (Vaporizer by Kaz, Inc., New York, N. Y.; cap molded by Pyro Plastics Corp., Union, N. J.)

FOOTBALL HELMET is three times stronger than any previously made. ZYTEL has high strength in thin sections. Nylon shell is resistant to abrasion . . . cannot dent. Resilience of ZYTEL helps take the shock out of the roughest scrimmage. (Helmet by Rawlings Sporting Goods Co., St. Louis, Missouri.)



PORTABLE WASHING MACHINE uses complex moldings of Du Pont ZYTEL nylon resin. ZYTEL provides light weight for ease of lifting, high strength to meet strong washing forces, chemical resistance to withstand soaps and detergents. Parts cannot corrode . . . are guaranteed by AMI for five years! (Washer by AMI, Inc., Grand Rapids, Michigan; parts molded by Michigan Plastics Products, Grand Haven, Michigan.)

Du Pont ZYTEL® nylon resins make products possible . . . existing products better

WHY are ZYTEL nylon resins used in such a great variety of the newest products? One answer is the availability of thirteen different formulations. You can obtain a wide range of melt viscosities, temperature ratings, chemical resistances. You can specify grades for molding, for extrusion, for use in solution.

ZYTEL cuts the cost of many production processes, helps you redesign old products and introduce new ones. Give your product a boost and carve out new markets with the help of ZYTEL—as so many manufacturers are now doing. Send the coupon for end-use and technical information.

DU PONT
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BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Department
Room 2711, Du Pont Building, Wilmington 98, Del.

Please send me more information on Du Pont ZYTEL nylon resins. I am interested in evaluating this material for _____

Name _____ *Position* _____

Firm Name _____

Street Address _____

City _____ *State* _____

Type of Business _____

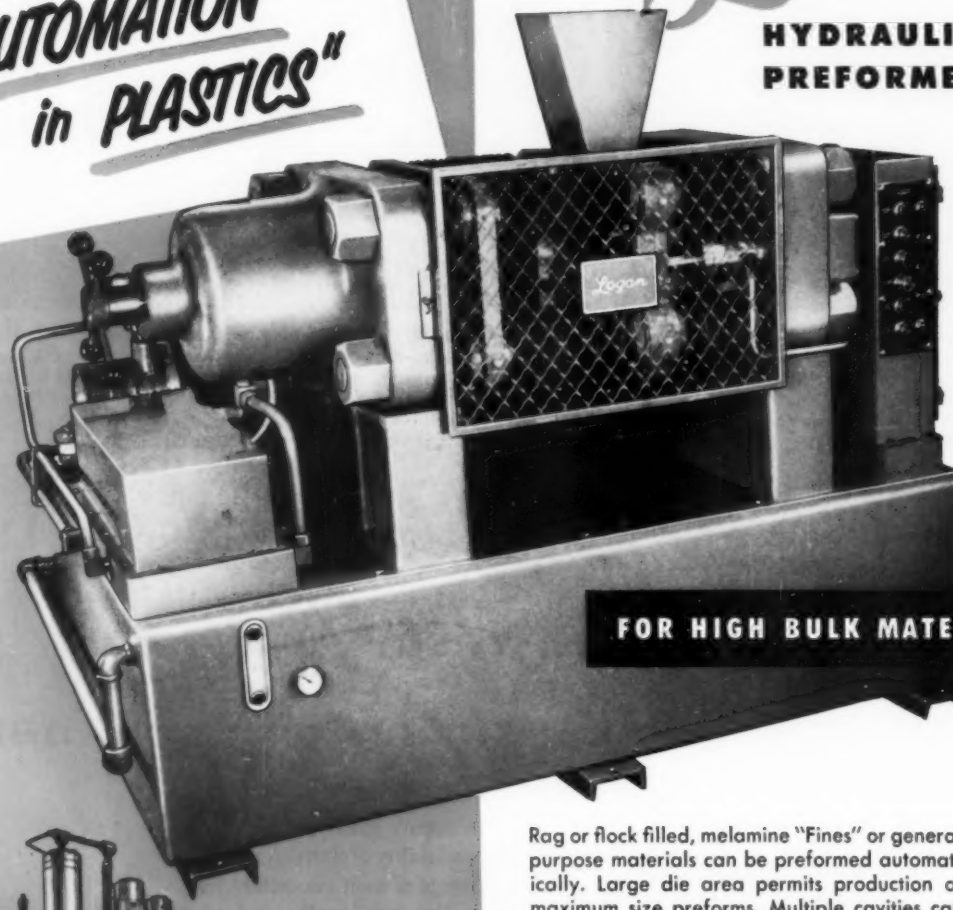
In Canada: Du Pont Company of Canada (1956) Limited, P. O. Box 660, Montreal, Quebec

A NEW
COST REDUCING FEATURE

"AUTOMATION in PLASTICS"

NOW POSSIBLE WITH THE *Logan*

HYDRAULIC PREFORMER



FOR HIGH BULK MATERIALS

Rag or flock filled, melamine "Fines" or general purpose materials can be preformed automatically. Large die area permits production of maximum size preforms. Multiple cavities can be used for smaller preforms. Processing with high bulk materials in your plant becomes automatic if you own a Logan Preformer.

If You Need a Hydraulic Press,

Check LOGAN Before You Buy

Automatic molding with Logan horizontal transfer machines and using preforms of high-bulk-factor type materials is the new way to reduce costs. Logan also has a complete line of semi-automatic molding custom engineered presses for compression and transfer use. Their exclusive features will appeal to you.

You will find it profitable to discuss your production problem with a Logan Engineer.

SEE US AT BOOTH 611

LOGAN HYDRAULICS, INC.

A SUBSIDIARY OF LOGAN ENGINEERING CO.

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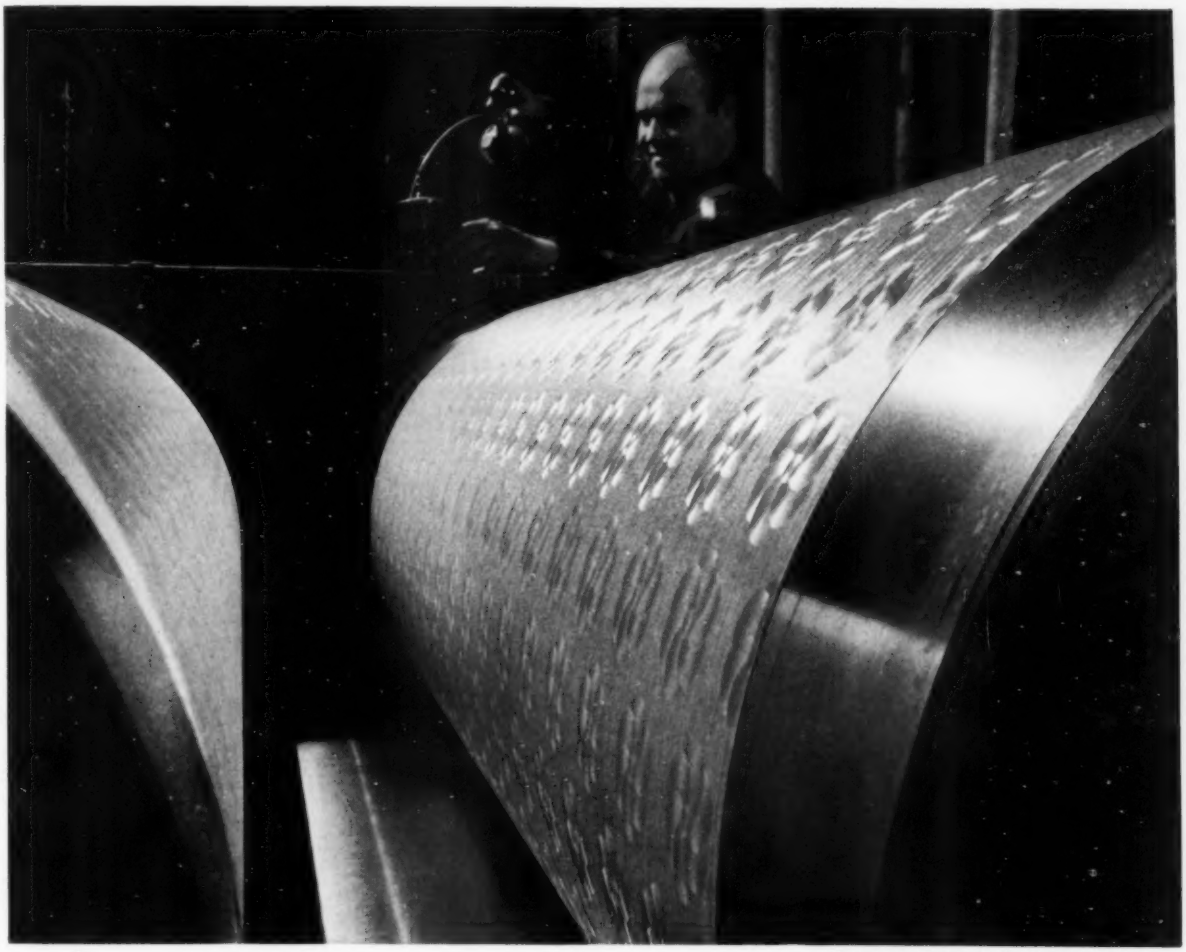


Photo courtesy Harte & Co., Inc., New York, N. Y.

Now—3-D and fluorescence, too

Coming off the calender above is a *doubly new* kind of vinyl film that has a striking, three-dimensional appearance and a never-before-achieved fluorescent color.

The three-dimensional effect is obtained through a unique embossing which utilizes Fresnel's theory on the absorption and reflection of light. The distinctive color is achieved through extra-careful compounding and processing of the heat-sensitive fluorescent pigments.

A major role in the successful production of this unusual film is played by PLIOVIC. Because it premixes and fuses at low temperatures, PLIOVIC minimizes heat degradation of both resin and pigment. It also embosses easily and provides excellent heat sealability. Other advantages are good heat and light stability and good, general physical properties.

The particular PLIOVIC used in this three-dimensional film is one of a family of vinyl resins designed to give you improved processing and/or end properties. For details plus the latest *Tech Book Bulletins*, just write to: Goodyear, Chemical Division, Akron 16, Ohio.

CHEMICAL
GOODYEAR
DIVISION

PLASTICS
DEPARTMENT

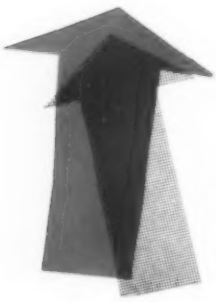
Chemigum, Plioflex, Pliolite, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

CHEMIGUM • PLIOFLEX • PLIOLITE • PLIOVIC • WING-CHEMICALS

High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

Opal 040 Flat and Corrugated 'Perspex' acrylic sheet is used by Personalised Plastic Signs Pty., Ltd., Australia, to make the illuminated faces of this large sign.

'Perspex' for signs



THIS 40 ft. x 10 ft. sign in Australia is made by Personalised Plastic Signs Pty., Ltd., Australia. The top section 6 ft. deep and the script letters are faced with opal 040 flat 'Perspex' sheet. Background and letters are internally illuminated with 20 mm. tubing.

The lower section 4 ft. deep is opal 040 corrugated 'Perspex' with flat Blue 'Perspex' cut out letters, changed by sliding along H channels. This section is illuminated by 8 ft. 25 mm. cold cathode tubing.

'Perspex' was chosen because its unique properties make it ideal for every sort of sign by day and night. It is tough and ensures minimum breakage during installation. It stands up to weather conditions in all parts of the world and is impervious to corrosive atmospheres in most industrial areas.

'Perspex' is an attractive, hardwearing material, easily shaped into novel and interesting designs. It has a high light transmission and is available in a wide range of transparent, translucent and opaque colours.

'PERSPEX'

'Perspex' is the registered trade mark for the acrylic sheet manufactured by I.C.I.

Imperial Chemical Industries Limited, Plastics Division: Export Dept., Black Fan Road, Welwyn Garden City, Herts.

U.S.A. enquiries to :
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Canadian enquiries to :
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Acetate Sheeting...

the perfect plastic material for blister and skin packaging. JODA extruded acetate sheets, rolls and film in light to heavy gauges—translucent, transparent or opaque—are excellent for vacuum forming.

Our new line of clear Acetate Butyrate and low pressure, high density Polyethelene sheeting is now available for immediate shipment.

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8th National Plastics Exposition
and P. P. I. Annual National Conference

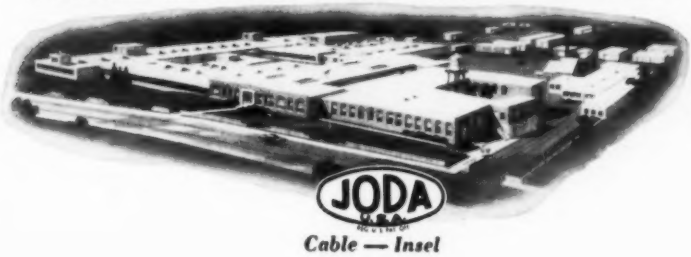
International Amphitheatre
Chicago, Ill.
November 17th through November 24th
Booth #914

For information and samples, contact

JOSEPH DAVIS PLASTICS CO.

430 Schuyler Ave.,
Kearny, N. J.

Phone WYman 1-0980-0981
N. Y. BArclay 7-6421-6422



Sales Representatives
Conveniently Located

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ALSTEELE *Granulators and Pelletizers*

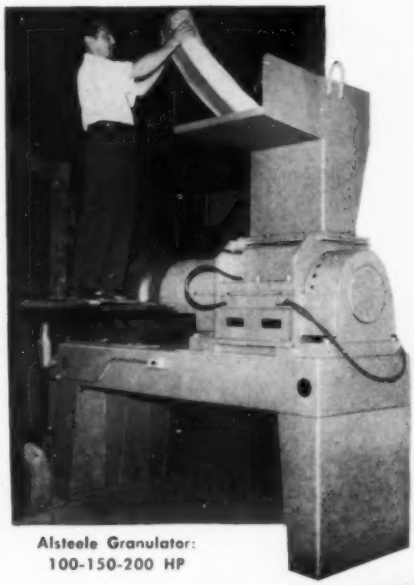
are all the name implies—and more!

Alsteele Granulators

ALSTEELE GRANULATORS handle the entire range of thermoplastics, whether the material be .001" film or 11"-thick chunk solids. Even the largest molded objects require no prior sawing. And ALSTEELE GRANULATORS cut polyethylene and vinyl so the bulk factor will approximate your virgin material.

For extra durability, the Granulator cutting chambers are *all steel* . . . for extra strength, the hardened forged rotor is machined from *all steel* . . . and for smooth, constant cutting the two large heavy duty flywheels are *all steel*. Heavy duty machines are *water cooled*.

To meet your every need in plastics reducing machinery—whether for beside-the-press operation or for heavy duty chunk grinders — ALSTEELE GRANULATORS come in 26 models ranging in size from 3 HP to 200 HP, with cutting chambers up to 5'.



Alsteele Granulator: 100-150-200 HP

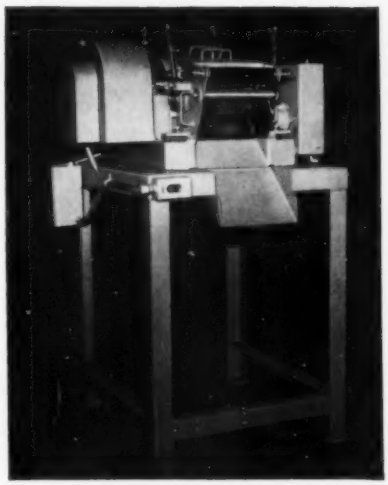
Beside-the-Press Granulators in a complete range of sizes

WATCH FOR IT!
The ALSTEELE Exhibit at Booth 312 NATIONAL PLASTICS EXPOSITION in Chicago. Nov. 17-21.

Alsteele Pelletizers

The Alsteele line of pelletizers works with extruders 2½" to 6" or larger. Instant synchronization with an extruder is made possible by the U. S. Varidrive. And ease of operation, maintenance and cleaning is insured by extremely compact design.

Additional features are excellent uniformity of pellets, and clean cutting action—even on elastomerics. A greatly lowered noise level is still another benefit.



Hi-Speed Pelletizers to handle entire extruder output

Call or write our office nearest you for full price, performance and specification data.

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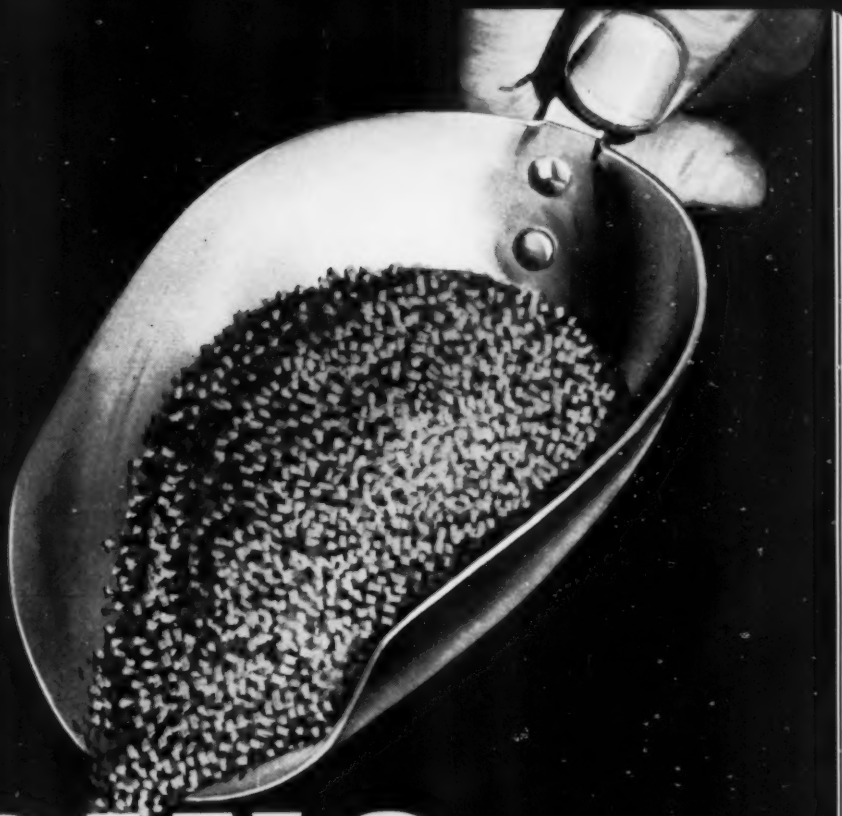

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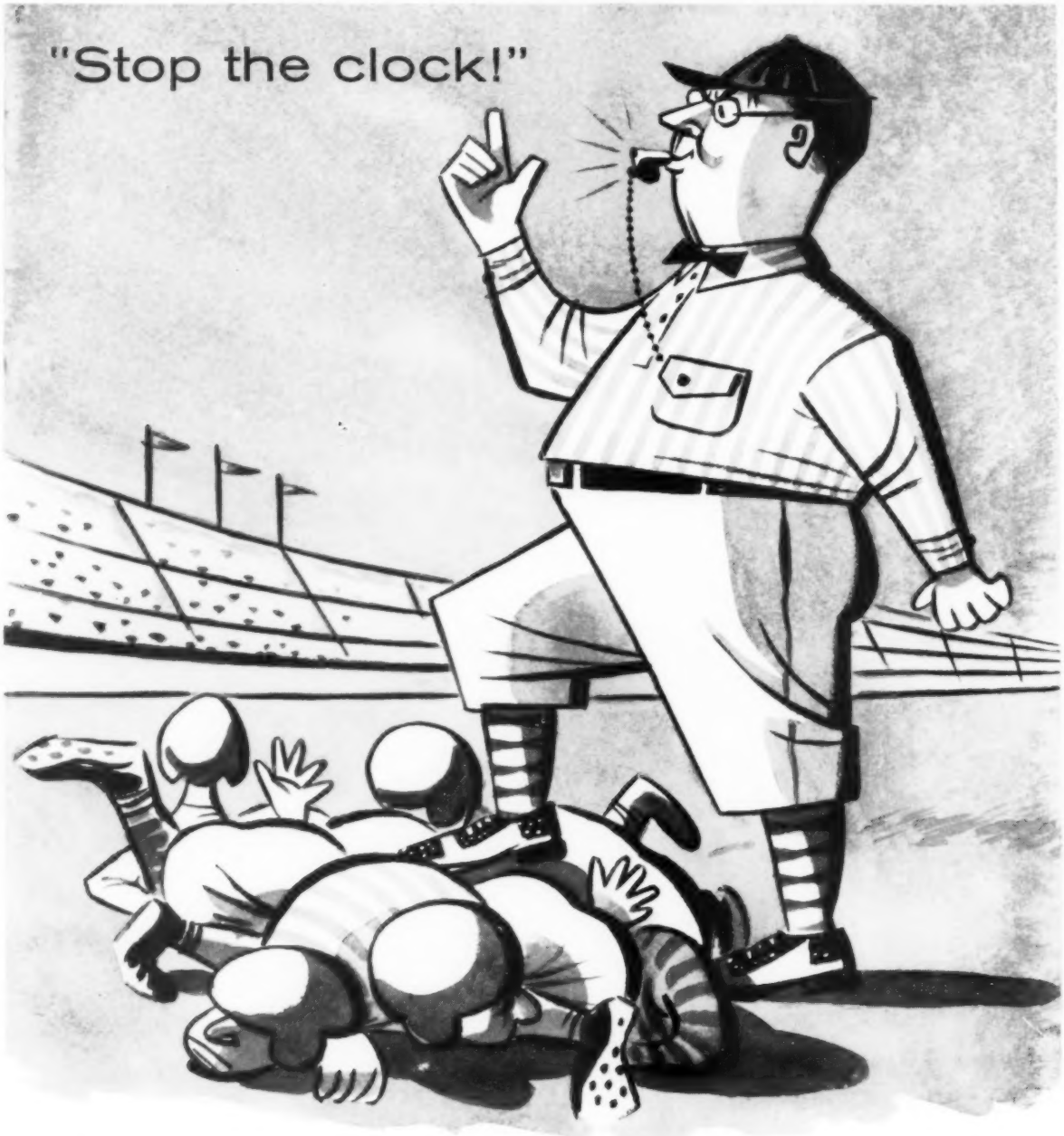


They can in football. Basketball, too. Same with soccer, ice hockey, water polo and even rugby.

But not in custom molding. Much as we'd often like to, we can't stop the march of time and turn out production miracles.

So we follow a long established policy of doing the next best thing. Namely:

We plan our production schedules as realistically as possible. We keep our customers as up-to-date as possible on the status of their orders. And if something does go wrong, such as a mold breakdown, we are completely honest about it and inform our customers as promptly as possible.

This way there are fewer "fumbles." Fewer "rebounds." Fewer "kicks." And everybody "knows the score."

Many of America's most distinguished companies have discovered it—you can, too: "tossing" us a tough job leads naturally to the formation of a "winning combination."

So—how about "passing" us some of your problems—real soon?

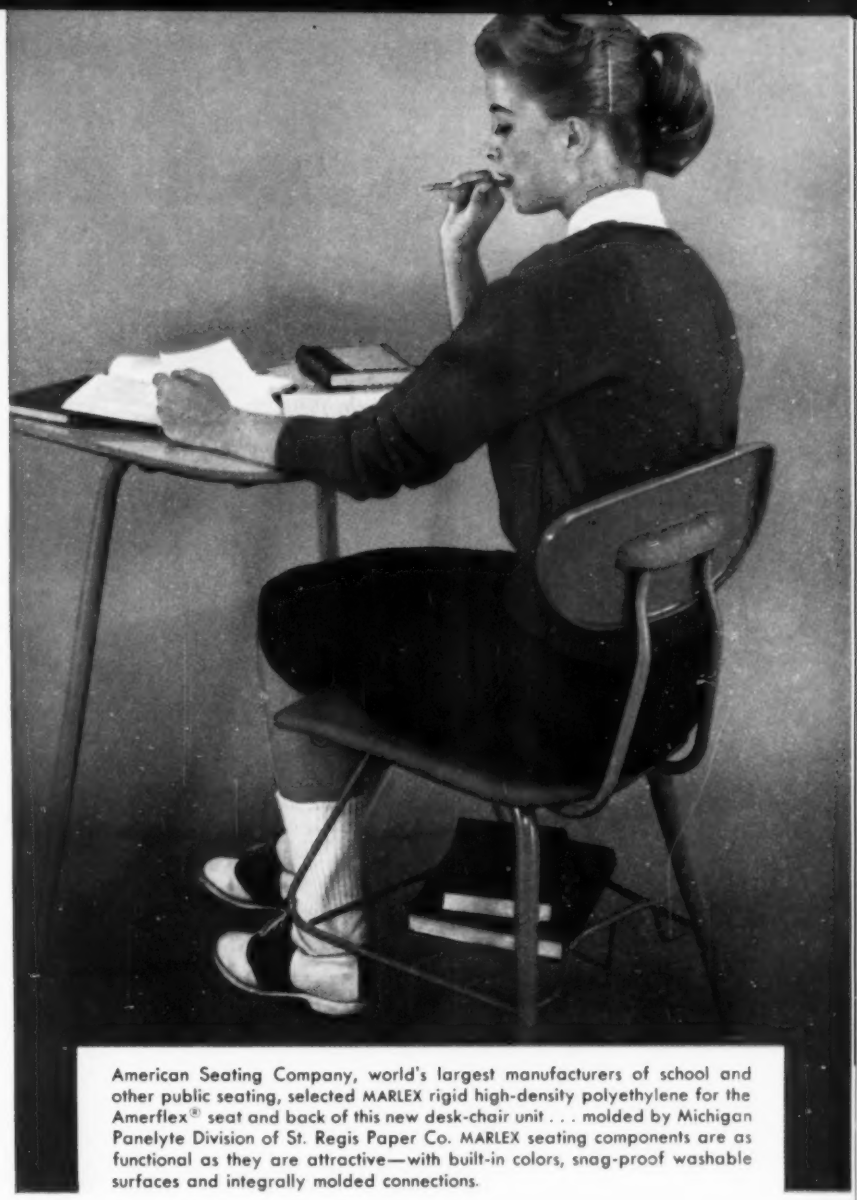
BOONTON MOLDING CO.

BOONTON, NEW JERSEY

New York Metropolitan Area—Cortlandt 7-0003
Western New York Area—Alden 7134
Connecticut Area—Woodbine 1-2109 (Tuckahoe, N. Y.)
Philadelphia Area—Pioneer 3-0315

New MARLEX furniture components include: (1) drawer glides and bearings molded by Prolon Div., Pro-phy-lac-tic Brush Co., Florence, Mass. (2) "Floormate" furniture glides, made by Childlore Corp., Kansas City, Mo., and (3) self-lubricating center drawer guides, glides and dowel pins molded by Reiss Mfg. Co., Little Falls, N. J.

MARLEX filaments are woven into attractive long-wearing upholstery and drapery fabrics such as the material on this office chair (below right), as well as durable, weather-proof furniture webbing like this popular "do-it-yourself" material woven by Thomas Taylor & Sons for Webcraft, Inc., Bridgeport 6, Conn., who developed this new market.



American Seating Company, world's largest manufacturers of school and other public seating, selected MARLEX rigid high-density polyethylene for the Amerflex® seat and back of this new desk-chair unit . . . molded by Michigan Panelyte Division of St. Regis Paper Co. MARLEX seating components are as functional as they are attractive—with built-in colors, snag-proof washable surfaces and integrally molded connections.

Modern furniture uses MARLEX*

. . . to reduce costs of key components

More and more furniture manufacturers are switching from wood to plastic components molded from MARLEX. These new components have no joints to come unglued . . . they are dimensionally stable—won't absorb moisture to cause warping and sticking. Furthermore, MARLEX components have smooth snag-proof surfaces, with molded-in colors, that are easy to clean and maintain and never need refinishing . . . and they are tough, durable and can be molded to any shape.

MARLEX is impervious to cleaners, shampoos, polishes, waxes or moth-proofing compounds—and is unaffected by temperatures from —180° to 250° F. MARLEX components are non-rusting, non-staining and self-lubricating. They can be injection molded, vacuum-formed, extruded or cast and machined. *They cost much less than comparable nylon or reinforced polyester components.* In fact, no other type of material can serve so well and so economically in so many different furniture applications. Write to your nearest MARLEX sales office for further information.

*MARLEX is a trademark for Phillips family of olefin polymers.

PHILLIPS CHEMICAL COMPANY, Bartlesville, Oklahoma

A subsidiary of Phillips Petroleum Company

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Because they have gained wide acceptance by the molding industry, Plenco 433 and 482, General Purpose Blacks are both produced in large volume. Orders for these compounds repeated from the same molders over and over again, attest to their advantages for general purpose applications–

gp GENERAL PURPOSE PHENOLICS:

433 · 482 BLACKS

- They are efficient to use because they are fast of cure; moldings made from them are clean and crisp in appearance.
- They accept a wide pre-heat latitude, and are not hypersensitive to small changes in molding conditions.
- Their molded physical and electrical properties are also of high quality.

Although we will never stop improving our formulations, Plenco 433 and 482 do represent many years of specialized experience in supplying phenolic compounds to a critical and competitive molding industry. If you are not using these modern, tested-quality compounds, tell us the flow required and we will be pleased to forward a sample.

Plenco has, or can custom-formulate, the phenolic compound you need. Our representatives are, of course, always ready, willing and exceptionally able to serve you.

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FOR BETTER PLASTIC PRODUCTS

IF PHENOLICS CAN DO IT–

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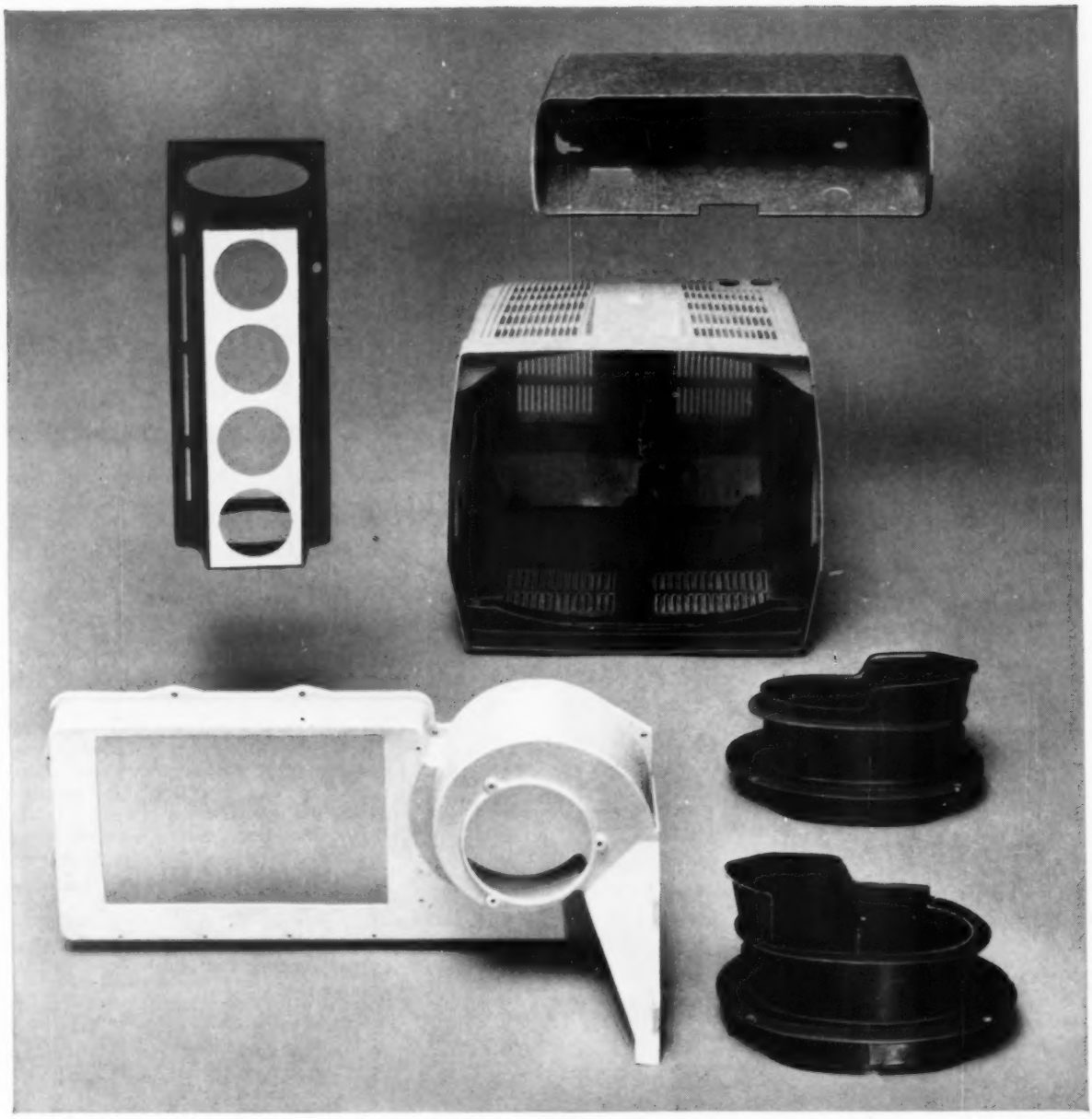
already-made or specially-made

PLASTICS ENGINEERING COMPANY

Sheboygan, Wisconsin

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins



Wide range of premix moldings by the Plastics Division of General American Transportation Corporation includes: automotive air conditioning cabinet for O. A. Sutton Corp., Inc.; Silvertone portable TV cabinet for Sears, Roebuck and Co.; air duct and glove compartment for a leading automobile manufacturer; vending machine air duct for Vendo Co.

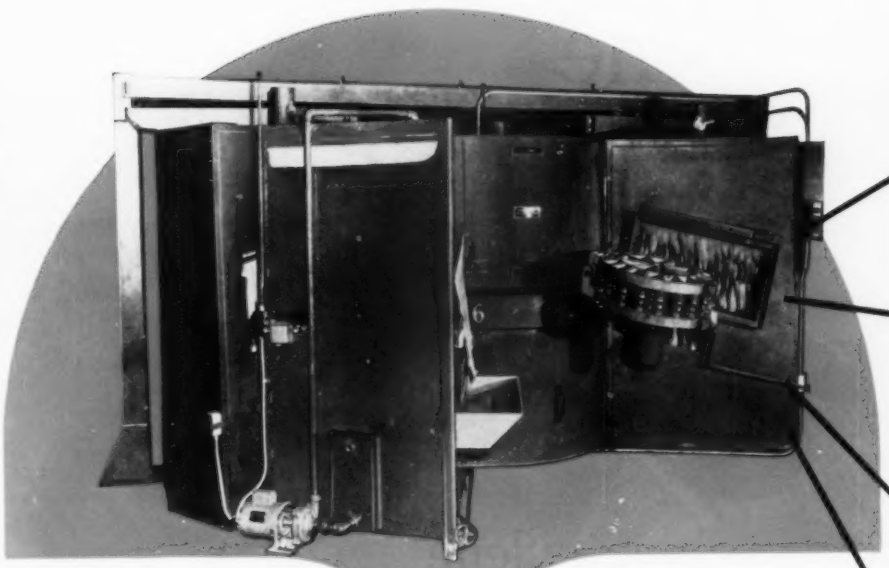
Premix moldings give you all three... quality, economy, versatility

Like to market better products and cut costs at the same time? Then premix moldings are for you!

When resins and reinforcing fibers are blended beforehand, more complex molds are not only possible but completely practical. Slots, grooves, holes, bosses and parts with varying wall thicknesses can be formed right in the mold. And whether the part is simple or complex, you'll get moldings with uniform strength and wall thicknesses. Premix moldings are improving products and cutting costs for a wide variety of industries using strong, rigid, reinforced plastics.

Molders across the nation rely on Dow Vinyltoluene and Dow Styrene for top-quality premix moldings. They can help you to better products at lower costs. For the names of molders and suppliers, contact your nearest Dow Sales office or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Dept. 2206F-2.

YOU CAN DEPEND ON DOW



MOLDING MAGIC!

MOLD UP TO 1620 BIG PROFIT ITEMS PER HOUR . . . LIKE MAGIC

PRESTO . . . PRODUCTION and PROFITS!

Yes, it seems like magic the way this machine converts raw material into finished goods, in one continuous operation. With only one man at the controls, polyvinyl chloride plastisols, vinyl foams, polystyrene expandable beads and polyethylene blends are automaticaly dispensed and rotationally molded to shape, completely controlled by the automatic features of the machine. The operator need not be a technician, because all the raw materials are scientifically prepared, using all the technological advances made by the nation's foremost companies. Now, any hollow article can be molded from these raw materials, thus creating countless new product possibilities. With a high hourly cost, it naturally folows that units produced on this machine are BIG PROFIT items.

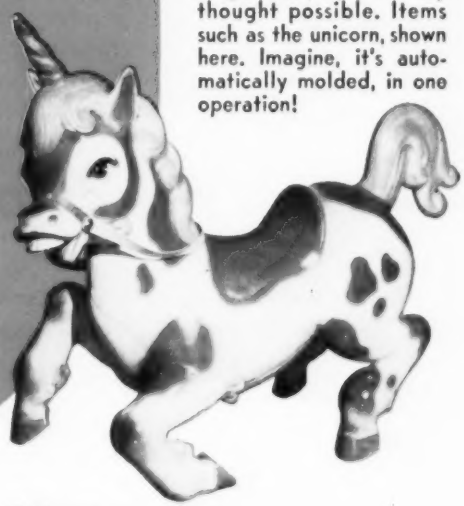
LET US SHOW YOU HOW TO DO IT!

We want to demonstrate our "magic" to you. Visit our plant and let us mold YOUR PRODUCTS, right before YOUR EYES . . . like "magic".

Write or call for detailed data or an appointment.

NOW . . . even BIGGER!

Machines are now available with a 15", 25" and 75" molding area, able to mold items *eight times larger* than previously thought possible. Items such as the unicorn, shown here. Imagine, it's automatically molded, in one operation!



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Switch to Pro-fax, the versatile new plastic with a combination of properties never before available in a single material, and watch your profits grow.

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Chemically inert, Pro-fax resists solvents, greases, oils, most common chemicals and acids, and is immune to environmental stress cracking.

Combined with all these functional advantages unique in this new thermoplastic, Pro-fax has strength, rigidity, good surface hardness and excellent color and finish in a low-cost plastic that lends itself to low-cost production by a variety of processing methods.

Complete data on product and mold design available on request. Call or write:

Cellulose Products Department

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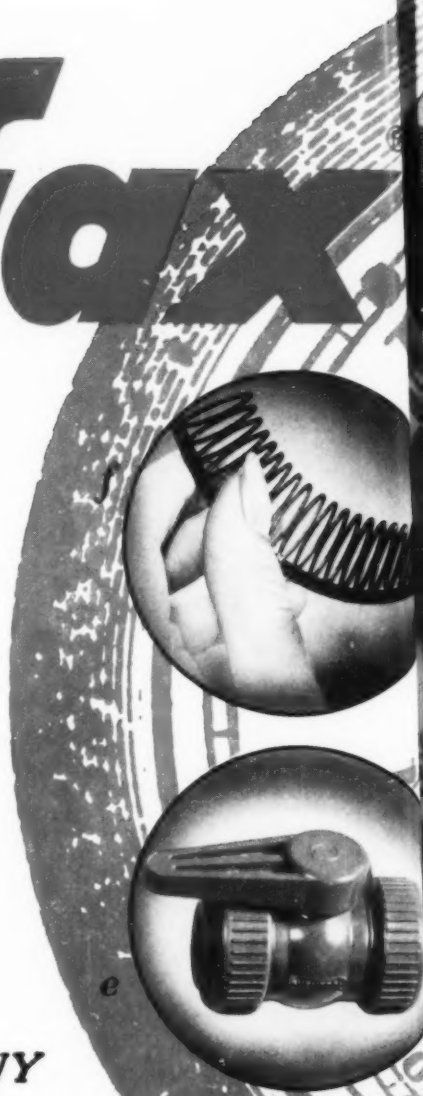
THREE NEW MATERIALS FOR THE PLASTICS INDUSTRY

Hi-fax® High-density polyethylene • Pro-fax® Polypropylene • Penton® Chlorinated polyether



a PACKAGING FILMS based on Pro-fax have excellent tear and tensile strength; are heat sealable and have good printability.

b ECONOMICAL TO MOLD, these Pro-fax electrical connectors have high heat resistance.

c TOUGHNESS & RIGIDITY in a chemically inert material make Pro-fax ideal for pipe fittings.

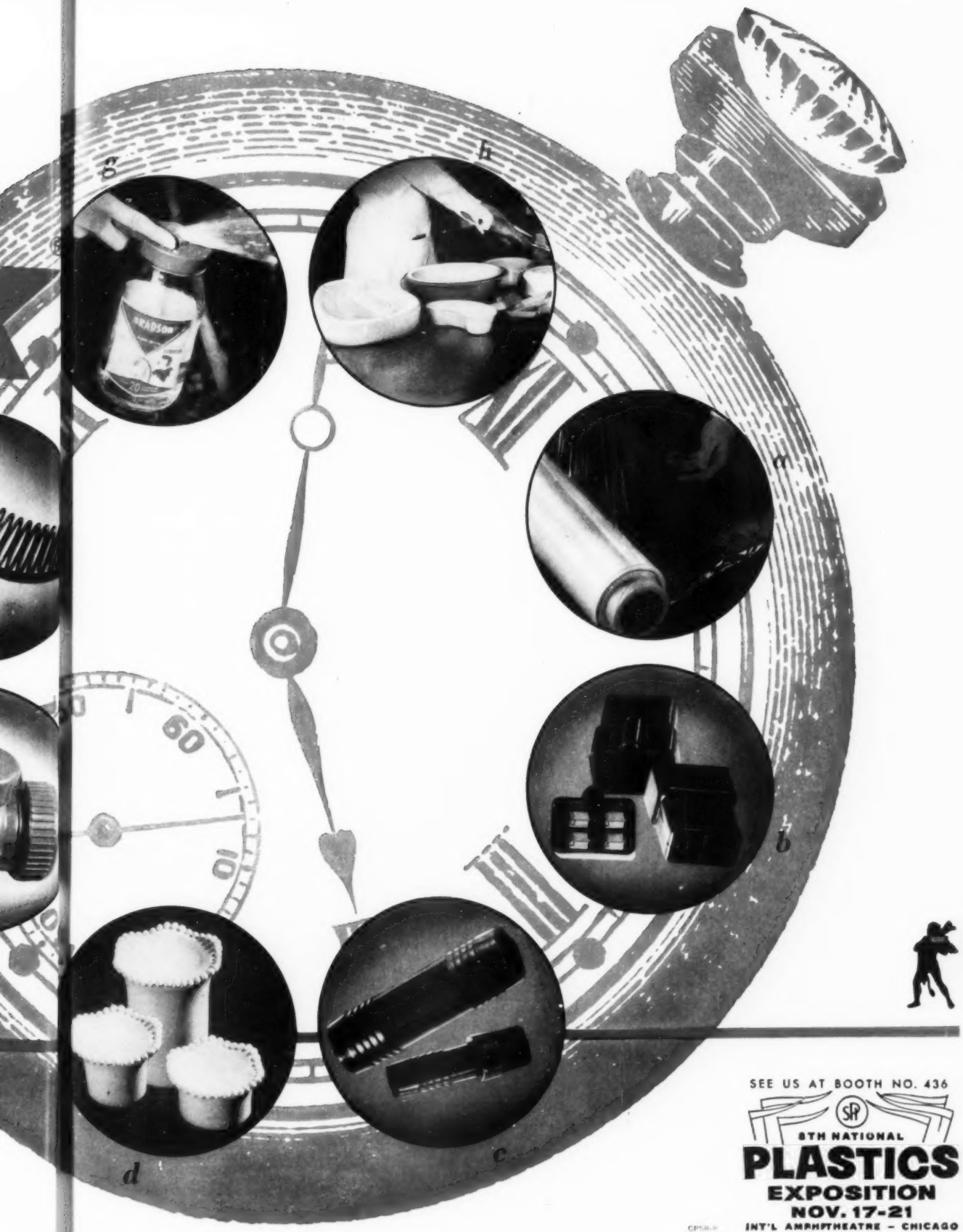
d STYLING and functional advantages are combined in Pro-fax closures for hard-to-package products.

e COMPLEX SHAPES held to close tolerances can be readily molded in Pro-fax.

f HAIR ORNAMENTS illustrate the resilience, rigidity, and lightweight toughness of Pro-fax.

g CHEMICALLY INERT, Pro-fax can be used in many fields previously served by metal.

h HEAT STABLE at 300°F., hospital utensils made with Pro-fax can be steam-autoclaved.



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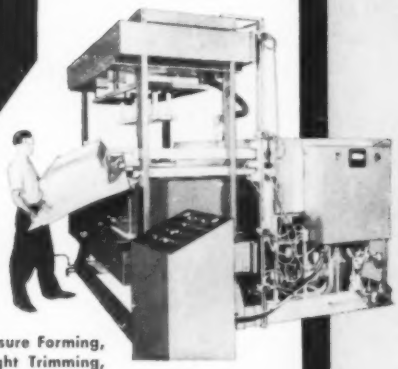
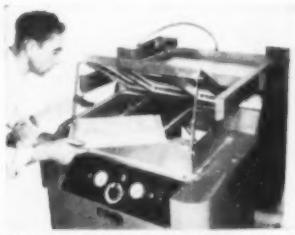
Comet

VACUUM FORMING MACHINES

COMET LABMASTER
Automatic Double Platen Drape and Vacuum Molding Machine. Permits full versatility of thermo-sheet forming.



COMET STAR
Snapback Forming, Pressure Forming, Mechanical Forming, Light Trimming, all incorporated into one machine.



COMET LABMASTER (Model 1420)
Close-up view of single platen laboratory and sampling machine.

- **Sheet Plastic Forming of Products**
- **Skin Packaging**
- **Blister Packaging**

Many parts and products now made from metal, wood, fibre and glass can be produced in Plastic by Comet Vacuum and Blister Forming at considerable savings.

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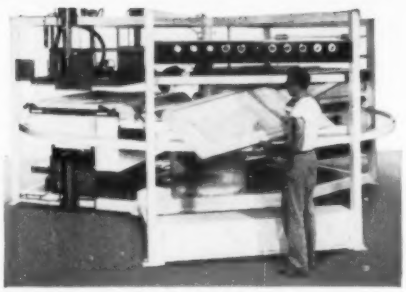
Economical Drape and Vacuum Forming Machine. Completely automatic for Vacuum Forming or Skin Packaging.

COMET QUICK-PAK
Fully automatic skin packaging, blister and vacuum forming in a compact, easy-to-operate unit.

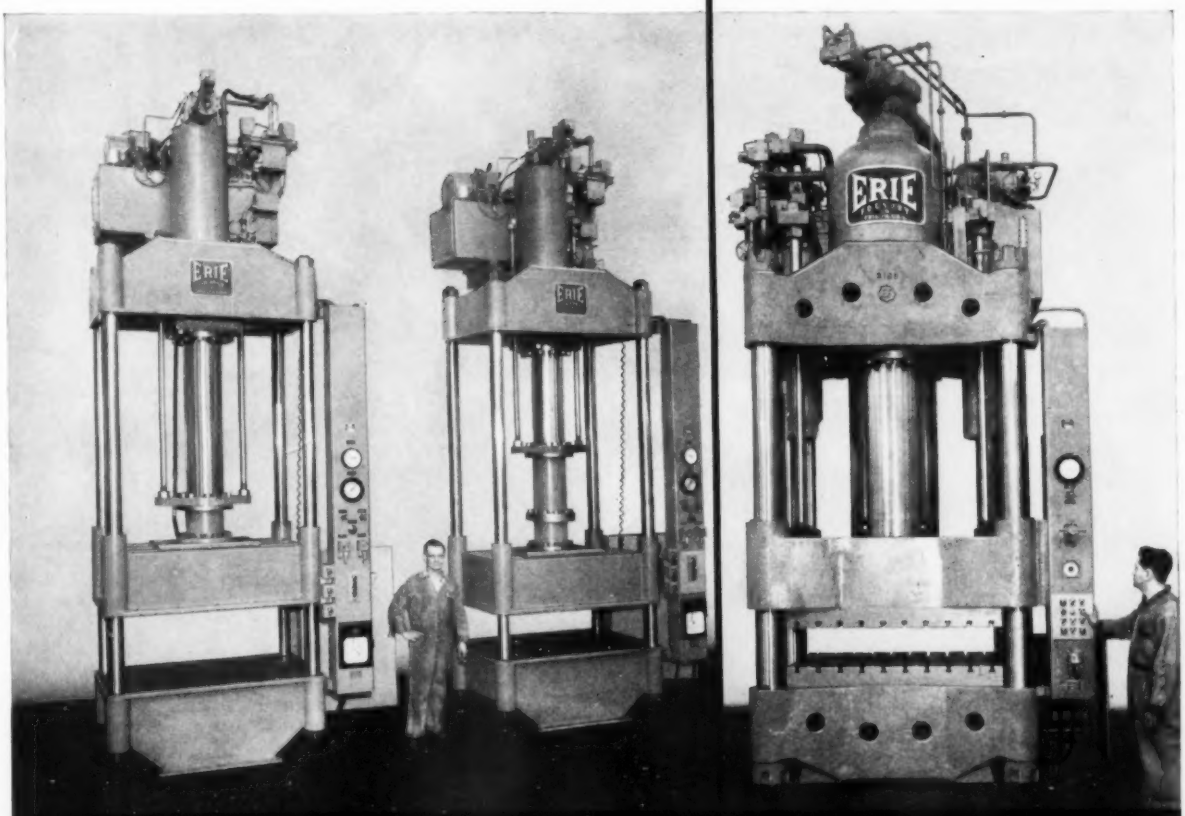


COMET ROTARY-VAC
Three station vacuum forming machine for high production.

Vacuum, Drape and Snap-Back Forming. Operator loads and unloads at one station — all other operations fully automatic. Also available with male assist.

These two 150-ton fiberglass molding presses offer 48" stroke... 54-ton pull back. When desired, the opening can be reduced by ram spacers which, in this case, are 12" and 24". The Oil Gear drive offers molders a very accurate pressing speed adjustment ... the ultimate possible. Controls are semi-automatic; plates are 56" x 42". Your maintenance men will welcome the minimum piping and valving on these self-contained presses.

This very rugged fiberglass press is rated 750 tons with a 48" stroke. The two pull backs give 150-ton stripping capacity. Oil Gear drive with quick-acting prefill system allows molders to utilize five ram speeds in their molding cycle. Automatic short stroking of pump at required pressures for long periods of time assures both reduced h.p. consumption and oil heating. Controls are semi-automatic, and the 2 steam-heated platens are 60" x 46".



THERE'S AN ERIE PRESS for EVERY FIBERGLASS MOLDING JOB

Whatever your molding needs, plastic, fiberglass or rubber, why not consult Erie Foundry before you plan? We can be of great help.

For more information, please write:

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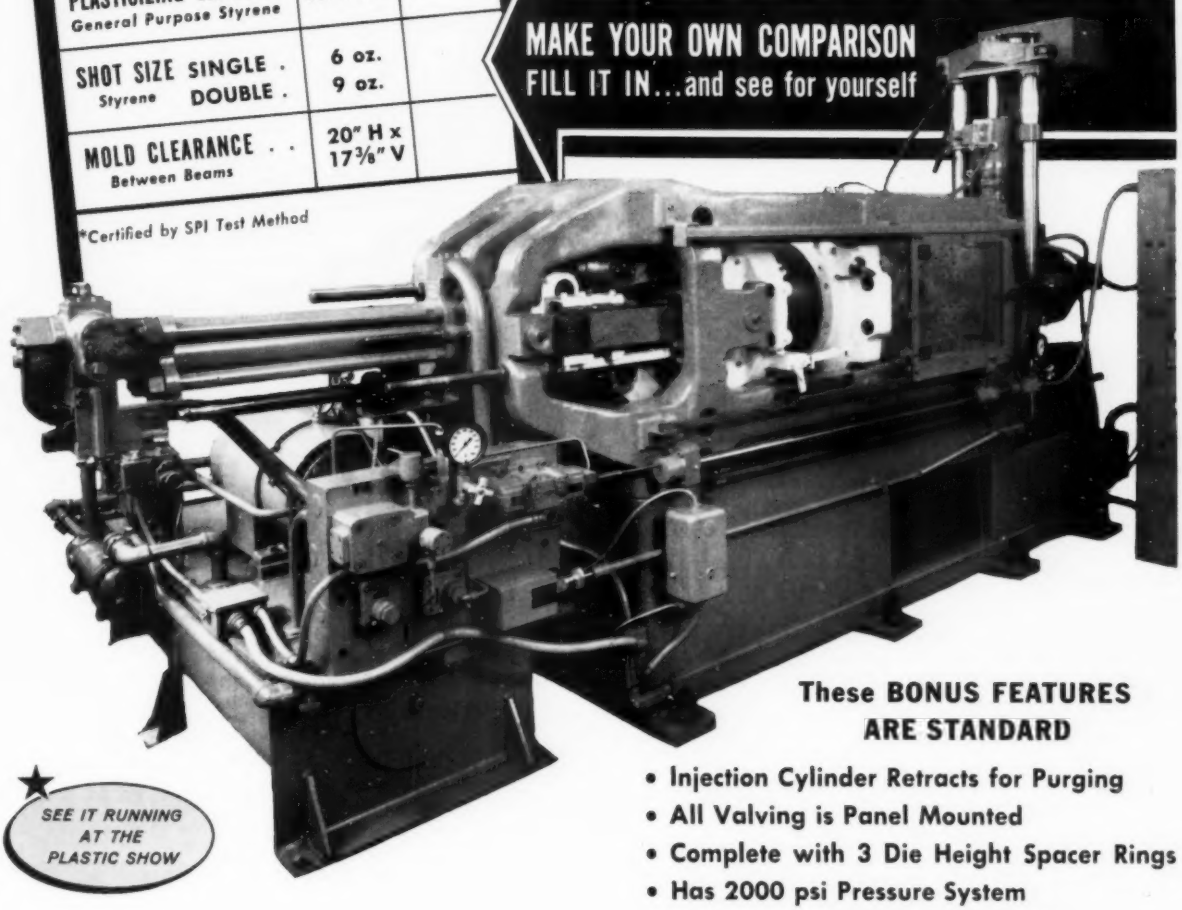
L-225-6/9 oz.

BASIC SPECS	6/9 oz. LESTER	Any other machine
STROKE, ADJUSTABLE . .	16" to 8"	
DRY CYCLE 8" Stroke 16" Stroke	4 secs. 5 secs.	
DAYLIGHT	38"	
CLAMPING TONNAGE*	225 tons	
PLASTICIZING CAPACITY General Purpose Styrene	150#/hr.	
SHOT SIZE SINGLE . Styrene DOUBLE .	6 oz. 9 oz.	
MOLD CLEARANCE . . Between Beams	20" H x 17⅜" V	

*Certified by SPI Test Method

MAKE YOUR OWN COMPARISON
FILL IT IN...and see for yourself



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- Has 2000 psi Pressure System
- Incorporates SPI Standard Ejection
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In numerous preliminary comparative tests on production molds, the L-225-6/9 oz. Lester has shown spectacular qualities of versatility and capacity. It is bound to become a new standard for specifications in its class. We invite you to test your own molds in the 6/9 oz. Lester to see what it can do for you.

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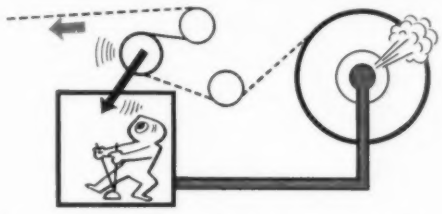
check your unwind tension controls

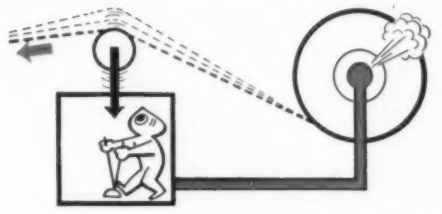
If you want more profitable production from high speed winders, slitters or web-fed printing and processing machinery, **first check your unwind web tension controls!** No matter what material you work with, remember this...a relatively low investment in a dependable Cameron unwind tension control system will protect your profits by permitting higher, more productive operating speeds...by improving the quality of your finished product...and by minimizing loss through snap-offs. A fully automatic Cameron tension control system can be custom-fitted to meet the exact requirements of the material, the speed and the web-fed process with which you are concerned.

CAMERON 900



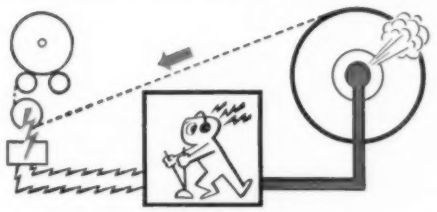
Extraordinary range and sensitivity assures instant correction of extreme parent roll irregularities. Versatile range of **MODEL 900** provides constant tension on a wide variety of plastic films, foils and papers. In **MODEL 900,** the fully automatic brake pressure control mechanism is actuated by low-inertia, low-friction dancer roll which moves in a horizontal plane to provide slack take-up on the unwinding web. This system provides exceptional range for extreme correction problems.

CAMERON WEB-TROL*



A highly accurate, fully automatic web tension control system which provides extremely fast correction for many types of roll-fed printing and processing equipment, as well as for slitters and roll winders. In **WEB-TROL,** the brake pressure control mechanism is actuated by a sensing roll which moves .010" in a vertical plane. Vertical travel of the sensing roll is governed by variations in down-pull on the unwinding web as it slackens or tightens, due to parent roll irregularities. *patent pending

CAMERON CAMATROL*



A low cost, dependable, fully automatic system for maintaining constant web tension control. **CAMATROL** can be applied to many types of roll processing machines. With **CAMATROL,** the brake pressure control mechanism is actuated by an electric impulse which is governed by variations in load on the rewinding drive as the unwinding web slackens or tightens. *patented

Three systems to choose from!

IT PAYS TO START your processing run with dependable control of the unwinding web. Reduce your costs, improve the quality of your finished product, and get more profitable production at higher speeds by starting with a Cameron custom-fitted web tension control system. Replace old, inadequate controls now, and see the difference! Ask Cameron specialists to tell you all about **CAMATROL, WEB-TROL,** and **MODEL 900.** Write, wire or phone today.

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To resist corrosion, drums, tanks, and other large irregularly-shaped objects are sprayed with a structurally strong **chem-o-sol.** Cost savings of up to 35% result, and films of from 5 to 100 mils are possible.

To provide an essential coating for glass yarn used in strong, weather-resistant screening, a **chem-o-sol** with the correct flow properties was produced for economical application by high-speed die-wiping. *(Owens-Corning Fiberglas Corp.)*

To produce a tight seal that is permanently flexible and durable, a specially formulated **chem-o-sol** was tailored for clay pipe joints. A "flowed-in" gasket, it's applied by an in-plant molding process.

What they're doing with

may suggest an easier way to

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chem-o-sol ALSO HELPS CUT PRODUCTION COSTS

These are just a few of the applications already developed for Chem-o-sol. So versatile is this polyvinyl dispersion . . . so advanced the research, so vast the formulating experience and production capacity of Chemical Products Corporation that Chem-o-sol's product improvement possibilities are virtually *unlimited.*

For Chem-o-sol is more than a coating or molding *compound.* It is a new production tool! Formulated as a liquid without volatile components, it is converted to a strong, resilient solid simply by heating to about 350°F., *without pressure.*

Since each Chem-o-sol formulation is "tailor-made" to best suit the specific requirements of the end use, the formulator's touch is indispensable for translating ideas into reality.

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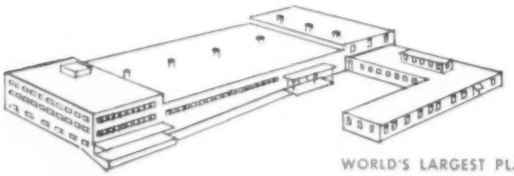
IS THERE AN IDEA HERE for improving your own product? Then tell us about the proposed end use of Chem-o-sol.



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To impart a slip-proof, safety grip and increase wearability of cotton work gloves, palms and fingers are strategically dotted with **chem-o-sol** specially formulated to permit printing on fabrics at high speeds. *(Wells Lamont Corp.)*

To deaden noise, protect dishes from chipping, and resist grease and detergents, the familiar drainer is dipped in a special **chem-o-sol**. Wire constructions and metal and glass objects are coated easily and economically because only one dipping operation is necessary. Thickness to 60 mils is possible, in wide range of finishes.

To seal the new dry type automotive air cleaner into the car silencer and act as a structural member of the pleated paper element, a **chem-o-sol** was compounded for high-speed molding. Pre-cut gaskets and metal stampings were eliminated. *(From Corporation.)*

To improve heat resistance and physical and electrical properties of coatings for flexible sleeving (spaghetti tubing) used in electrical components, a **chem-o-sol** was tailor-made for heat resistance of more than 2000 hours at 225° F.

improve your product

TECHNICAL FACTS ABOUT chem-o-sols

Chem-o-sols possess all the outstanding physical and chemical properties associated with polyvinyl chloride resins. Listed below are some of the properties available in almost any combination.

COLOR CHOICE — unlimited

TENSILE STRENGTH — as required from 1000 psi. to 2700 psi.

PERCENT ELONGATION — 350 to 600

HARDNESS (shore A2) — as required from 10 to 100
(shore D) — up to 65

FLEXIBILITY — to temperatures as low as —65°F

CHEMICAL RESISTANCE — outstanding to most acids, alkalies, detergents, oils and solvents

HEAT RESISTANCE — available to 225°F for as long as 2000 hours and to 450°F for over two hours

DIELECTRIC STRENGTH — minimum of 400 volts per mil when fused in sections 3 mils thick and over

SOLIDS CONTENT — 100%. Chem-o-sols can be molded in very thick sections

VISCOSITY — as required for dipping, die wiping, molding, casting, spraying, or spreader coating

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Dept. P-11, King Philip Road
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Title .....

Company .....

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City ..... Zone ..... State .....

Proposed end use .....

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Application method .....

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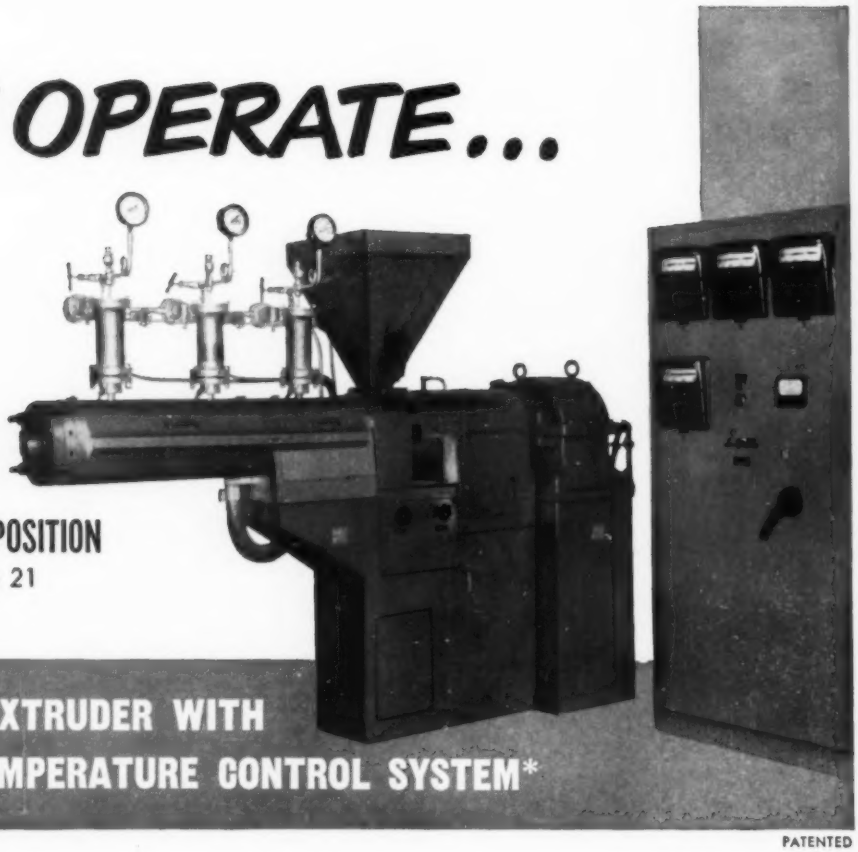

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The Plastiscope*

November 1958

News and interpretations of the news

By R. L. Van Boskirk

Section 1

Epoxies in fourth dimension. Thanks to a new oxidizing process developed by Union Carbide, there will soon be four major types of epoxy resin on the market instead of one as at present. Over 95% of all epoxies today are produced from a reaction of an alcohol (bisphenol in this case) and epichlorohydrin. The three new Carbide epoxy resins are all derived from petrochemical products based on natural gas materials. The materials are designated Epoxide-201, dicyclopentadiene dioxide, and vinylcyclohexene dioxide, and exhibit a wide range of properties.

The Carbide resins are different in several respects from the bisphenol-epichlorohydrin type. For example, Epoxide-201 has a viscosity which is much lower—it flows like water and is thus easy to pour into a complex mold such as a gear. In epoxy resins the hardener must be stirred in, which creates danger of trapped air bubbles, in Epoxide-201, the bubbles escape before the resin sets. Epoxide-201 will not discolor with exposure to light, according to the producer. Its heat distortion point varies like that of other epoxies. The range for the older types goes from 200° F. up to 400° F. for the real fancy systems; but when an anhydride hardener is used, tests have shown the Carbide resin distortion point to be as much as 80° F. higher than a bisphenol resin under similar curing conditions.

There are also basic differences in the hardening system for the new Carbide epoxy. It reacts fast with acid groups—in minutes instead of hours. Traditional epoxies generally require an amine hardener in order to speed up the curing time, but frequently an acid hardener is more desirable from a properties point of view—heat resistance for example. Many of the acidic hardeners are lower in cost than traditional hardeners required to give similar properties and curing speeds.

Epoxide-201 will sell for 80¢/lb., which is about the same as other epoxies for plastics until they were reduced from 77¢ to 62¢/lb. two months ago. Development quantities are now available from Carbide at $1.50/lb.

Other uses for epoxides. Carbide also expects to market two combination plasticizer-stabilizer resins made from this new epoxide. These would be the first all-synthetic plasticizer of this type. Earlier systems were based on soy or other vegetable oil. The new resins would be unaffected by fungus.

Many other uses are expected for the epoxides. Among them will be vinylcyclohexene dioxide, an intermediate which can be polymerized to a three-dimensional resin and also can form condensation resins with dicarboxylic acids. There is dicyclopentadiene dioxide that can be formed into an epoxy with anhydride hardeners and polyol initiators (patent pending) for

*Reg. U.S. Pat. Off.

ANNOUNCEMENT!

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The Plastiscope

(*Continued from page* 39)

use in grinding wheels, brake linings and dry laminates—a test bar has withstood 572° F. Allyl epoxystearate is another possibility as a monomer that could be tailored to specific end uses. Caprolactone is another material on which a polyester-like laminating resin, a casting resin, or a rubber-like polyurethane might be used.

Because of these epoxides' great reactivity with other chemicals, it is probable that they will find uses never dreamed of today. Union Carbide has enough faith in their possibilities to build a 10 million lb. plant for their production which will be completed in mid-1959.

Rexall Drug buys Tupper operation. In the largest acquisition in its history, Rexall Drug Co. has purchased the Tupper Corp. and its subsidiaries. Earl Tupper will serve as board chairman of Tupper with headquarters in Woonsocket, R. I. Other Tupper molding plants are in Farnumsville and Blackstone, Mass. John Ansley, who has been with Tupper for many years will be president. Tupperware Home Parties Div. is also included in the purchase, and will continue its operations as in the past with Hamer Wilson continuing as president and Gary McDonald as executive VP. The transaction involved 175,000 shares of Rexall stock and a $5 million bank loan. The price tag is around $10 million. It is estimated that Tupperware may contribute over $1.5 million to Rexall's net income.

Tupperware distributors will continue to be the sole outlet for all Tupperware products—they will *not* be sold in retail outlets.

Rexall is rapidly becoming a potent factor in plastics operations. The company now owns Seamco Chemical Co., with a capacity of around 12 million lb. of polystyrene; Kraloy Plastic Pipe Co. and Chemtrol Co., a producer of plastic valves and fittings, both in Los Angeles. In addition to its various retail drug chains, Rexall also owns and operates Seamless Rubber Co., Eastern Tablet Co., two cotton converting plants, four drug manufacturing facilities, and Blum's confectionery products.

Latex paint for exterior wood surfaces. Dow Chemical has developed an acrylic latex paint resin for use on exterior wood surfaces. The announcement is important since the industry has had difficulty in producing a latex or water paint that would stick to exterior wood surfaces which had been previously painted with alkyd or oil paints. Paint made from the new latex will assertedly not only prevent passage of water from the surface to the interior of wood but also will permit passage of water vapor from the interior of the wood into the atmosphere. Heretofore, most of the Dow latices for paint resins have been the styrene-butadiene type—their acrylic latex is a surprise. One of their latest latices was a primer for metal now being used by Ford and recently reduced in price to 36½¢/lb., solids contained.

Diallyl phthalate for molding. New literature just released by the Chemicals and Plastics Div. of Food Machinery & Chemical Corp., New York, N. Y., calls attention to the vast scope of possibilities for its thermoset diallyl phthalate Dapon resin molding compounds. The material is often used for laminates with fibrous glass but FMC's feeling is that Dapon should play a more prom-

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Boost their toughness, weather resistance with "Dutch Boy" basic lead stabilization

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The Plastiscope

(*Continued from page* 41)

inent part in the molding industry and that, when volume is built up a bit more, its present high cost will decline.

For molding purposes Dapon resin is compounded (with diallyl phthalate monomer and various fillers) into finished powders that can be compression or transfer molded. It has several outstanding properties. It can be colored in any shade; its shrinkage factor is practically nil both in the mold and after use; it doesn't take up water or moisture; its heat resistance for continuous service ranges from 350 to 450° F., depending on the filler. Its first big scale use was in connectors for bulkheads in airplanes—it didn't shrink and allow the wires to come loose after long service.

In addition to its use in electrical application and in chemical plants (where its chemical resistance is important) the material is also suggested for appliance handles, radio and television cabinets, buttons, legs and lids, telephone hand sets, automotive hub caps, and even for dishware—where it would not present a stain problem.

FMC does not supply finished molding compounds but will furnish a list of compounders, together with complete information on properties and how to handle the material for best results.

Merger in glass. Johns-Manville Corp. and L. O. F. Glass Fibers Co. are planning to merge. L. O. F., second largest firm in glass fiber, was formed in 1955 by a merger of Glass Fibers, Inc., with the Fiber Glass and Corrulux divisions of L. O. F. Glass Co. Glass Fibers was founded in 1944 by R. H. Barnard who will continue as president. Johns-Manville has been a leading producer of industrial insulation for many years and will thus team up with L. O. F. in distribution of fibrous glass insulation, which consumes about 50 million lb. of phenolic resin annually. The Corrulux division is one of the leading producers of fibrous glass-reinforced panels and fits neatly into the Johns-Manville building material field.

Another vinyl chloride plant. Air Reduction Co. and the Mastic Tile Corp. of America have formed the Cumberland Chemical Corp. to produce vinyl chloride monomer and polymer and a new type of plasticizer, details of which are not yet available. Cumberland will sell vinyl resins to Mastic at market prices. The new $10 million plant will be completed by early 1960 at Calvert City, Ky., where Air Reduction has an acetylene plant. Air Reduction holds a 60% stock interest and Mastic a 40% interest in Cumberland. Mastic is a producer of asphalt, vinyl-asbestos and rubber floor tile in four different plants. C. J. McFarlin will serve as president of Cumberland, which will become the twentieth commercial producer of vinyl chloride polymer in the United States.

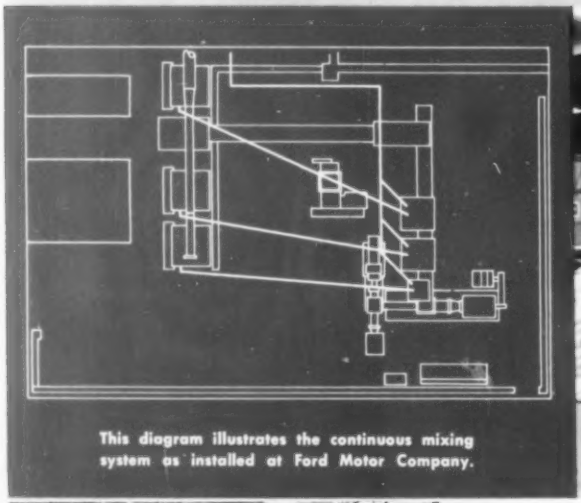
New phthalic at lower cost. It is still too early to determine what will happen to plasticizers as a result of the recent Amoco Chemicals, Chicago, Ill., announcement stating that phthalic anhydride would be available sometime in November at 17¢/lb., compared to the old list price of 21 cents. The question is will Amoco have enough to create a general price decline in phthalic or will a two-price system be established? DOP plasticizers which are dependent on

FORD MOTOR COMPANY
installs BAKER PERKINS machinery for continuous production of re-inforced plastic pre-mix

To achieve all the advantages of automatic processing, Ford Motor Company has installed a completely integrated system for the production of re-inforced plastic pre-mix on a continuous basis. A Baker Perkins Ko-Kneader has successfully solved this tough mixing problem and is the key piece of equipment in the system. Because of this remarkable technical accomplishment, it has been possible to achieve a whole new concept in automated pre-mix production. Baker Perkins supplied all the auxiliary equipment for conveying, weighing and feeding the component materials which included resin, sisal, clay, asbestos and calcium carbonate, as well as the equipment for forming and cutting off the pre-mix after discharge from the Ko-Kneader.

The machines of Baker Perkins manufacture in this installation include: four dump hoppers, complete pneumatic conveyor systems, belt transfer conveyor, resin pump and a model K-250-IM Ko-Kneader.

With this new automated system, Ford Motor Company has been able to capitalize on all the advantages of continuous processing and achieve a production rate of 1800-2400 lbs. of high quality pre-mix per hour. You, too, may be able to utilize the many advantages of the Ko-Kneader for continuous processing. Why not write today for complete information.

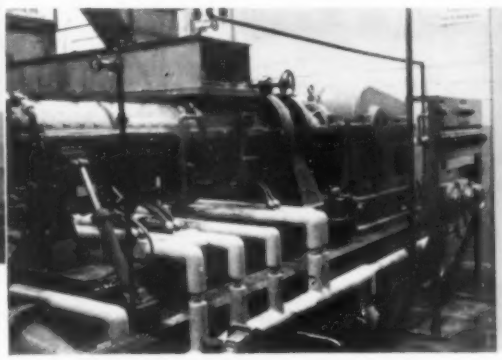


This diagram illustrates the continuous mixing system as installed at Ford Motor Company.

From these B-P dump hoppers the asbestos, clay and calcium carbonate are conveyed by a Baker Perkins pneumatic system to the mixing room. The sisal (second from the left) is moved by a mechanical conveyor.

Close up view of the Baker Perkins model K-250-IM Ko-Kneader. Feed conveyor is at the top, center. Discharge is at extreme lower left.

Overall view of mixing room. The overhead feeders discharge measured amounts of material on conveyor discharging into the Ko-Kneader.



See our insert in Chemical Engineering Catalog for additional information.

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BAKER PERKINS INC.

CHEMICAL MACHINERY DIVISION
SAGINAW, MICHIGAN

The Plastiscope

(*Continued from page* 43)

phthalic are now listed at 28¢ lb. but the price is not firm. Past history indicates that DOP goes down by $^1/_{10}$ of a cent for every penny's drop in phthalic—if the same pattern holds, a 17¢ phthalic could mean a 1.6¢ lower price for DOP.

The Amoco operation is a new low-cost direct oxidation process whereby phthalic, isophthalic, and terephthalic are separated from a mixed stream of raw stock in one operation. The capacity is thought to be about 60 million lb., but Amoco has not stated how much would be phthalic. Total phthalic use in 1957 was around 360 million pounds. This year looks about the same.

Isophthalic will be sold by Amoco at a price which is claimed to be on the same level as phthalic considering that a smaller amount is supposed to be needed to do a job. Isophthalic is used primarily in alkyds for paint and polyesters for reinforced plastics. It is sometimes used for plasticizers but requires a slightly more expensive technique.

Du Pont to make polyethylene film. An indication that the Film Dept. of Du Pont expects to get back into production of polyethylene film is a recent company press release which states that a laboratory and pilot plant for film production will be built adjacent to the company's resin plan at Orange, Texas. Facilities will be ready for operation in late 1959. This program does not alter the role of the company's Polychemicals Dept. as a supplier of polyethylene resin to the film industry.

Du Pont ceased production of polyethylene film shortly after the Korean war, but now asserts that new exploration of the field is desirable since technological advances and improved resins have widened the market areas.

Possible new acrylic molding material. J. T. Baker Chemical Co., Phillipsburg, N. J., is experimenting with a new, higher-heat-resistant acrylic molding material, but so far the material is only a laboratory job. The company is evaluating the material and possible markets before making it available even on a sample basis. It has about the same strength and hardness as conventional acrylic materials but has a heat distortion point that ranges in laboratory tests from 240 to 250° F. It can be extruded and injection or compression molded but so far at least it *cannot* be cast. If it becomes available in commercial quantities, the material would probably sell at about 10¢ lb. more than acrylic molding powders now on the market.

New application for high-density polyethylene. A new product with important possibilities and molded from Phillips Marlex material by Penn-Plastics Corp., Glenside, Pa., will soon be available to Pan American World Airways passengers as an overnight bag. According to Charles Kleiderer, president of Penn-Plastics, the initial order is for 350,000 lb. of material. Each bag will weigh about 1 pound. Design is by Edward L. Barnes Assoc., New York, N. Y.

For additional and more detailed news see Section 2, starting on p. 320

WOPALOID
Celluloid in sheets, tubes and rods
FOR PLASTICS – GO TO WORBLA
WOPALON
Cellulose Acetate in sheets, tubes and rods
WOPALIT
Acetate powder for injection molding and extrusion
Manufacturers of plastics for over thirty years.
Worbla-Plastics have proved their worth. So that you may see for yourself — we shall gladly provide you with samples.
WOPAVIN
PVC (Polyvinylchloride) in calendered and pressed sheets, tubes and rods. Compounds for injection molding and extrusion.
WORBLA
Nitrocellulose for lacquers and technical uses. Bleached linters
WORBLA LTD. PAPIERMÜHLE-BERN
WORBLA LTD.
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Switzerland

REAL FLEXIBILITY IN Automatics!

With a BAKER Automatic, mold changeovers are made in one-fourth the time required with other automatics.

This is because Baker Automatics offer:

4 open sides

large platen area

easy access at all times

lots of working space

quickly adjustable feeding mechanism for any mold combination — all supplied with the press. No additional loading boards to purchase each time molds are changed.

These advantages are yours in all BAKER Automatics — 60, 75, 100, 150, 175, 200, 300 and 450-ton sizes.
Write for general catalog and particulars.
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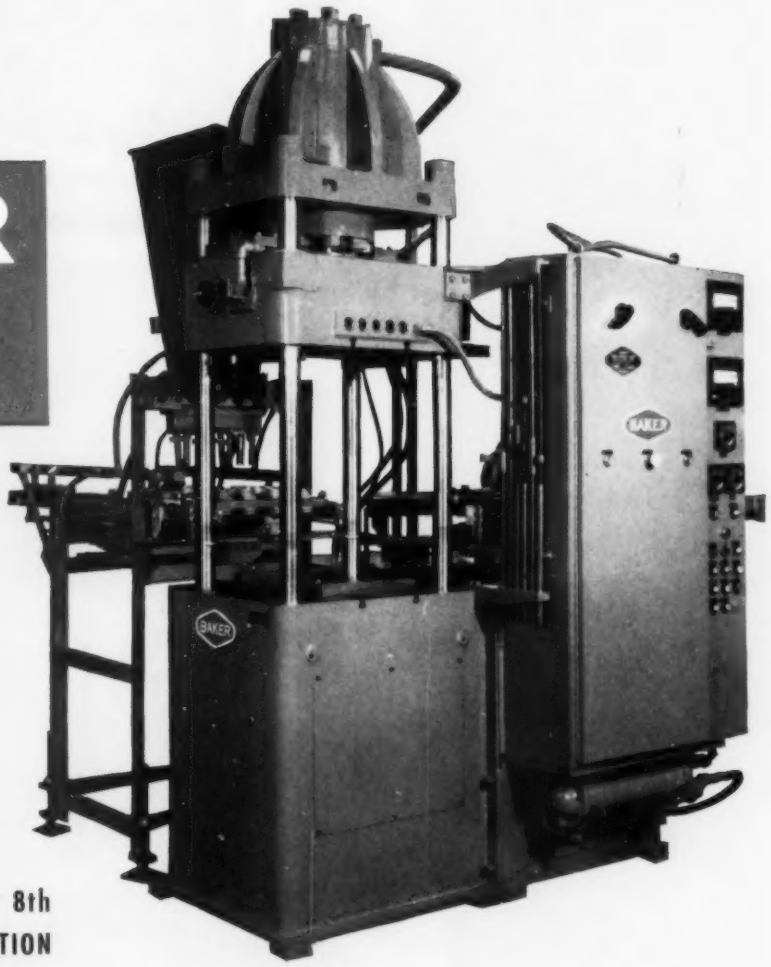
BAKER

AUTOMATIC MOLDING MACHINES



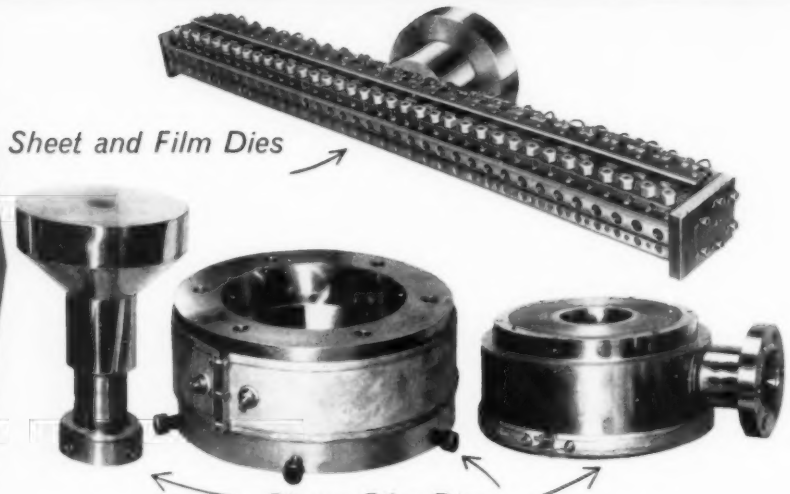
Baker 60-ton Automatic Molding Press. Hydraulic Working Pressure 2700 Max. P.S.I.

See Us IN BOOTH 610 at 8th NATIONAL PLASTICS EXPOSITION CHICAGO . . . November 17 to 21

From die to complete post extrusion equipment–

ROBBINS DIES:

Sheet
Flat Film
Blown Film
Pipe—rigid and flexible
Tubing
Profiles
Monofilament
Strands



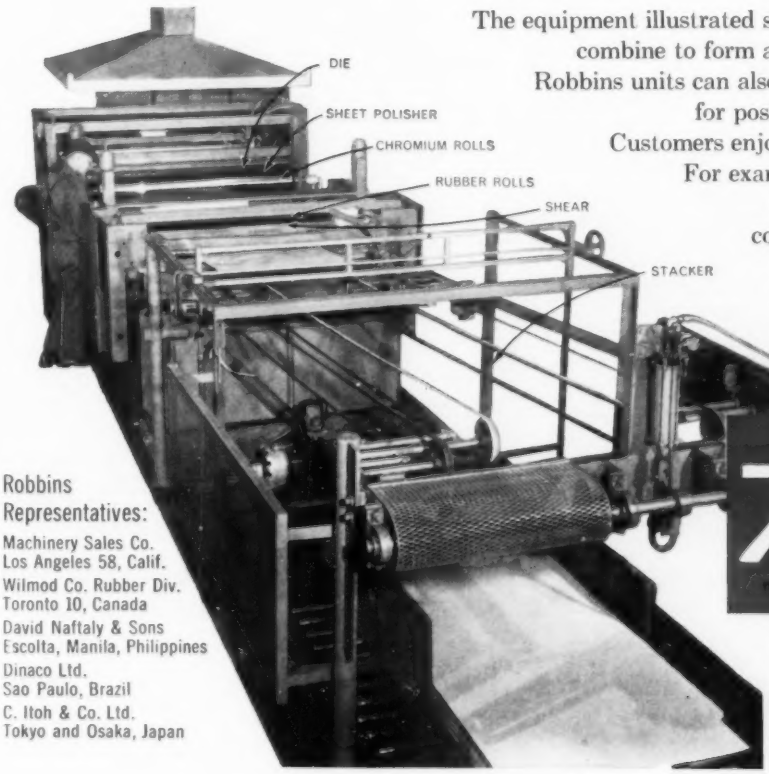
ROBBINS POST EXTRUSION EQUIPMENT:

Conveyors
Refrigerated Water Tanks
Shears
Capstans
Sheet and Film Wind Ups
Sheet and Film Haul-Offs
Sheet Polishers
Trimmers
Conveyors
Stackers
Monofilament Winders
Pipe Coilers
Heat Exchangers
Cut-Off Saws
Pipe Pull-Offs
Forming Tanks and Racks
Control Cabinets

CHOOSE ROBBINS

Whether it is a Die... Post Extrusion Equipment... Unit or Combination Sheet Haul-Offs you can count on Robbins engineering experience and production ability to work closely with you. Recent expansion of Robbins' engineering facilities permits active consultation, not only on Robbins standard line, but in the development or modification of processing equipment to meet your particular needs. Robbins haul-off equipment is *designed for all extruder makes* and can be furnished in a complete line with extruder of your choice with full line guarantee. All inquiries given prompt attention.

ROBBINS engineered and ROBBINS built



The equipment illustrated shows how capably Robbins units combine to form a complete line haul-off assembly. Robbins units can also be mounted on individual bases for positioning that best fits your needs. Customers enjoy definite installation economies. For example, the Heat Exchangers in the Chromium Roll haul-off unit are completely pre-piped. Temperature Controllers, pumps and all electrical work is finished and ready.

Let Robbins be your "early bird."

Please write

Robbins Representatives:
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C. Itoh & Co. Ltd.
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Robbins
never say die... say Robbins die

ROBBINS PLASTIC MACHINERY CORP.
Subsidiary of Lynch Corp., Anderson, Ind., U.S.A.
1430 Mishawaka St., Elkhart, Ind.

When you need plastics

...it pays to call an

AUTHORIZED PLEXIGLAS DEALER

See the Rohm & Haas exhibit at the National Plastics Exposition, Chicago, Nov. 17-21. Booths 600 through 608.

Here's why: He is a one-stop source for complete service on PLEXIGLAS® acrylic plastic and a wide range of other plastics and accessories such as cements, paints and cleaners. He is qualified to give fabrication assistance and technical advice. And above all, he can give you prompt delivery on almost any size and thickness of PLEXIGLAS—clear transparent sheets ... transparent and translucent colored sheets ... patterned, corrugated and extruded sheets ... and rods and tubes.

PLEXIGLAS

Look for this familiar trademark in the Yellow Pages of telephone directories in most major U.S. cities.

Chemicals for Industry

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

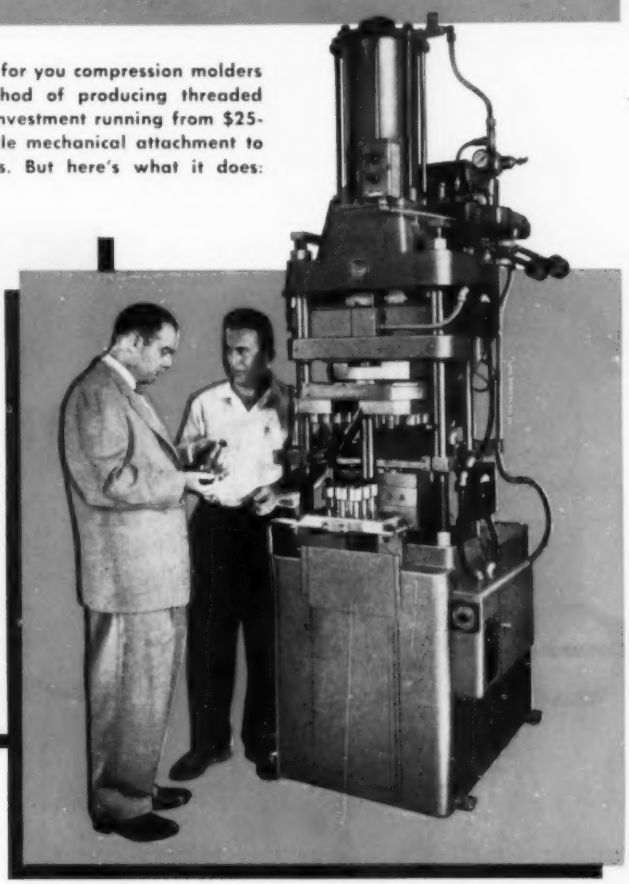
Canadian Distributor: *Crystal Glass & Plastics, Ltd., 130 Queen's Quay East, Toronto, Ontario, Canada.*

NOW for LOW-cost threaded plastic parts

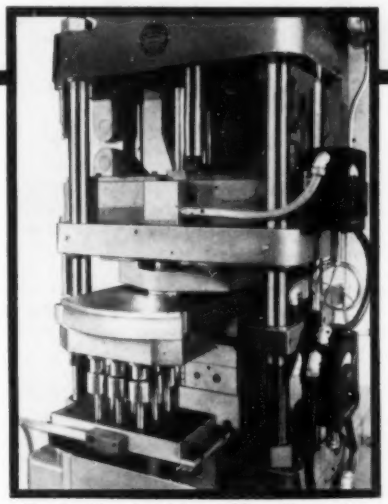
THE New LOW-COST THREDMOLDER

Thredmolder is Automold's revolutionary solution for you compression molders who need a genuinely low-cost automatic method of producing threaded closures, caps and parts. And without the usual investment running from $25-30,000 and up. Thredmolder is a relatively simple mechanical attachment to the Automold A50-B compression molding press. But here's what it does:

- ***Thredmolder eliminates time lag for unscrewing parts from mold, as parts are unscrewed simultaneously with recharging, closing and molding . . .***
- ***Thredmolder is capable of opening and closing in 4 seconds, the curing period alone determining the complete cycle . . .***
- ***Thredmolder makes any small or volume runs economically and efficiently, ONE cavity or fifteen . . .***
- ***Thredmolder molds different sizes or specialties at the same time . . .***
- ***Thredmolder molds any thread—internal, external, also internal and external of different pitch on the same part, including reverse tapers.***



Automold A50-B with Thredmolder, showing mold opened with upper plate rotated 90°



Thredmolder closed for molding. Unscrewing collets in foreground.

You not only gain this almost universal performance, you drastically reduce tooling cost by eliminating gears, racks and cams in the mold. No ejector pins are needed. Completely mechanical, Thredmolder is built-in but may be removed quickly for reconversion to our conventional high speed compression molding machine.

Remember, Automold can't be matched for low investment, one-man line operation, minimum maintenance, standard air line installation, fast mold change and dependable air toggle design. Send for full information and name of representative near you.

2233 S. Butler Ave., W. Los Angeles 64, California; Eastern Office: 400 Midland, Detroit 3, Michigan

AUTOMOLD

AUTOMATIC MOLDING MACHINE COMPANY

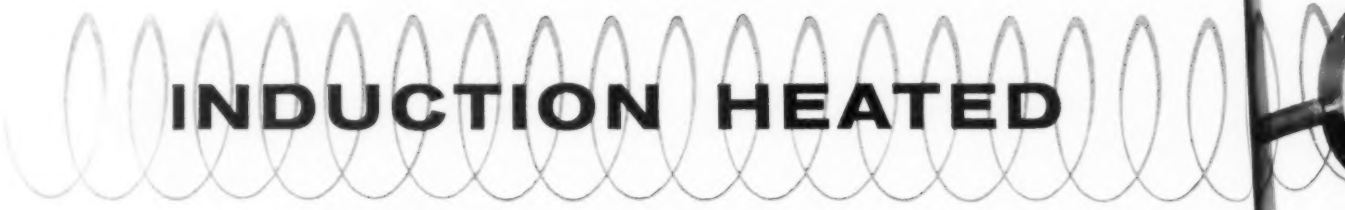
Subsidiary of Wagner Brothers, Inc.

See Automold's Thredmolder and 10-ton Automite in action at Booth 648 The National Plastics Exposition, November 17-21

10,000 P.S.I.

new

CONTROLLED PRESSURE



INDUCTION HEATED

extruders

MANY PRODUCTION AND COST ADVANTAGES

HIGH OUTPUT • Users report excellent production, usually greater than the next larger size of conventional extruder.

CONTROLLED PRESSURE ASSURES QUALITY • The product formed from these machines will be of superior quality as a result of the controlled pressure plasticizing action of the screw. This pressure can be maintained independently of die pressures or screen pack conditions.

SAVINGS IN OPERATING COSTS • The use of effective thermal insulation around the cylinder and head, a feature of induction heating, minimizes radiation losses. The high-speed screw with high-pressure valve permits increased mechanical power input. The combination of these features results in significant savings in over-all power costs per pound of production.

ONE-THIRD OF WARM-UP TIME • This new heating method permits fast, accurate control over a wide range of temperatures up to 800° F. Expensive, bothersome heater replacement is eliminated. Heat-up time will be approximately one-third that of other systems.

ADJUSTABLE, SELF-CLEANING VALVE • Located directly ahead of the screen pack. Complete with pressure gauge, the valve opening is adjustable continuously while running by the operator through a unique mechanism in the thrust housing.

AUTOMATIC WATER COOLING • Plenty of cooling capacity for present and future . . . a high-thermal-capacity, recirculating water-cooling system operates under complete automatic control.

RUGGED CONSTRUCTION • Designed for three-shift, seven-day week operation, featuring oversized gearing and thrust bearing assemblies. Aetna-Standard is noted for rugged equipment.

LEAKPROOF, QUICK-OPENING HEAD • The breech-lock type, quick-opening die adapter assures leakproof sealing at the maximum design pressures of 10,000 lbs. p. s. i. . . . plus all the quick-opening features necessary for frequent screen pack changes.

Address inquiries to: Hale and Kullgren, Inc.
613 East Tallmadge Avenue
P. O. Box 1231 Akron 9, Ohio

AETNA
ENGINEERING COMPANY
STANDARD
PITTSBURGH, PENNSYLVANIA

Adjustable, self-cleaning valve. Located directly ahead of the screen pack. Complete with pressure gauge, the valve opening is adjustable continuously while running by the operator through a unique mechanism in the thrust housing.

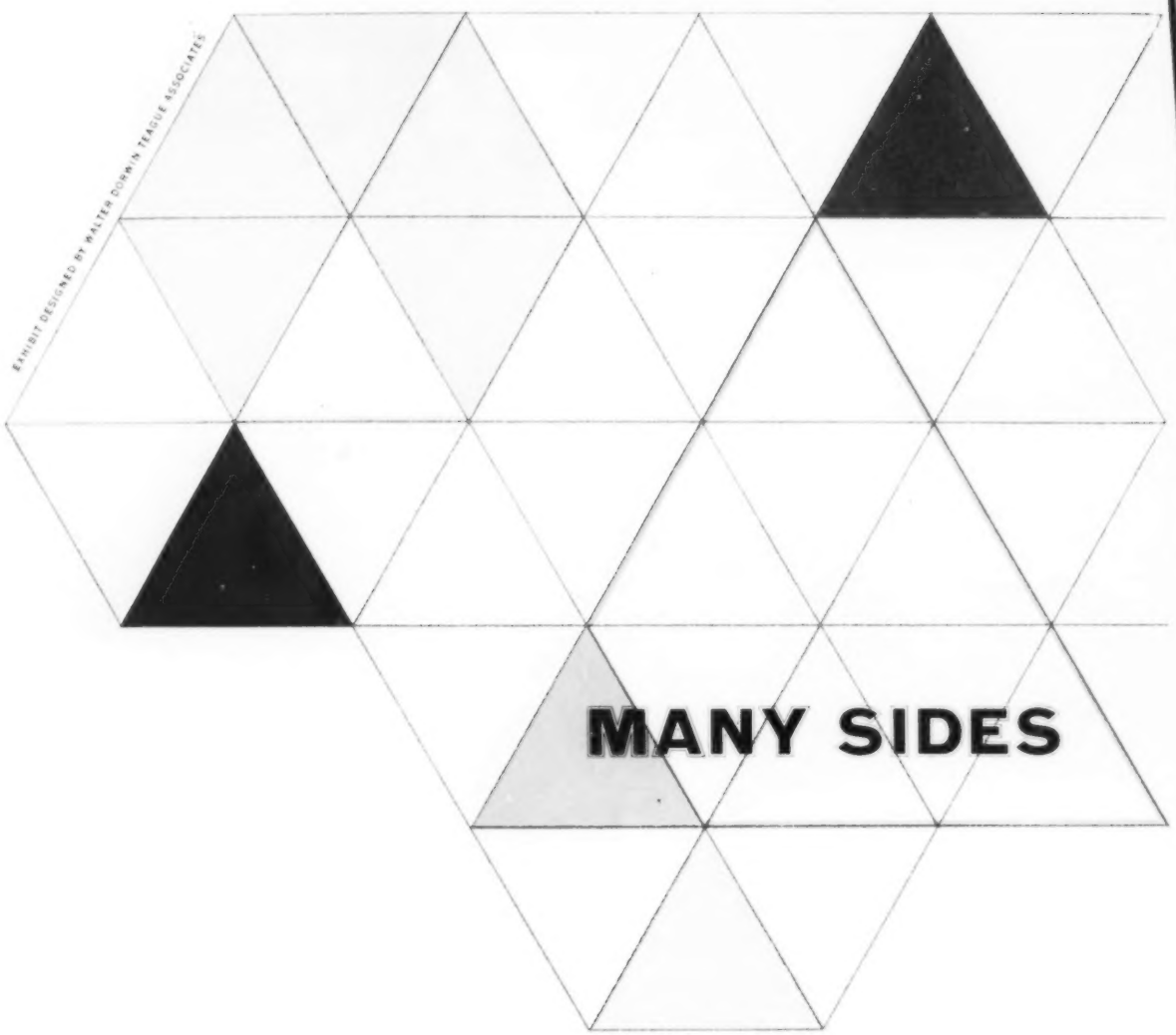
3½" adjustable high-pressure extruder features a 50 H. P. wide-range drive; 4 induction heating zones up to 800° F; automatically-controlled water cooling—3 zones; continuously adjustable screw pressure up to 10,000 p. s. i.; L/D ratio—20:1; quick-opening head, breech-lock type construction. These extruders available in standard sizes up through 8 inches.

HIGH-PRESSURE, INDUCTION HEATED, TUBULAR & FLAT DIES • We have completed development of a new line of dies for operation in combination with high-pressure extruders. These have been built in most sizes suitable for plastic pipe, also for blown and flat film.

LABORATORY EXTRUDER • L/D ratio—20:1; screw pressure control up to 10,000 p. s. i.; induction heat, 3-zone automatic controls; water cooling—3-zone automatic controls; load indicator; speed indicator—wide-range speed control; self-contained, mounted on caster base.

designed BY ENGINEERS WHO SPECIALIZE IN RUBBER AND PLASTICS

built BY THE CRAFTSMEN WHO BUILD RUGGED EQUIPMENT FOR THE STEEL INDUSTRY



Questions: Can you use high density polyethylene? If so, who should be your supplier?

Considerations: As with any plastic, many aspects must be taken into account . . . economic, technical and marketing. Each has many sides, many facets. And it pays to consult as many authorities as possible.

Conclusion: Make it a point to get the facts from the Grace Polymer staff. They'll be at the National Plastics Exposition: Booth 705, International Amphitheater in Chicago, Nov. 17-21. They will give you an honest, intelligent appraisal.

GREX*
HIGH DENSITY POLYETHYLENE

*TRADEMARK FOR W. R. GRACE & CO.'S POLYOLEFINS

W.R. GRACE & CO.
POLYMER CHEMICALS DIVISION
CLIFTON, N. J. CHICAGO, ILL.

MOLD MORE PLASTIC—*FASTER AND BETTER*

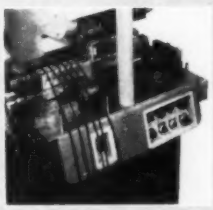
WITH A

Moslo Injection Molding Machine

Every day plastic molders are breaking production records with Moslo injection molding machines. They are discovering that Moslo machines will out-produce other machines with TWICE the rated capacity.

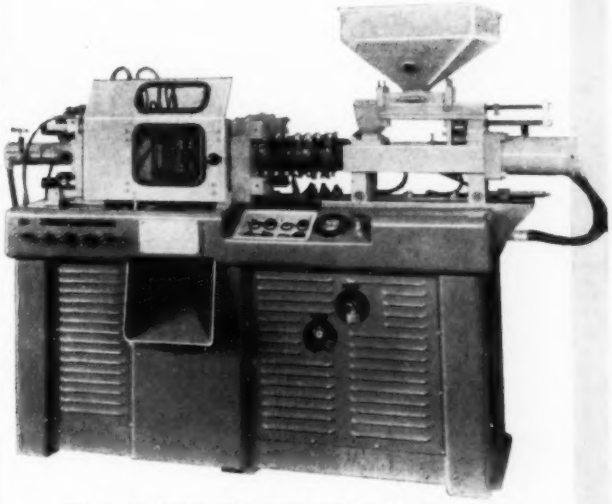
A Moslo machine will make greater profits for you whether you are making LONG or SHORT runs. It will accommodate any standard mold, has a greater plasticizing capacity and will inject more material into the mold and eject the part faster than any other comparable machine. It is ideal, too, for running nylon as well as other thermo plastic materials.

Illustrated on this page are Moslo machines. In order to fully appreciate their many advantages, you should see them in operation. Therefore, we cordially invite you to bring your own molds to our Cleveland headquarters and let us demonstrate exactly what a Moslo machine can do for you. Call or write and we will gladly arrange an appointment.



The 2-station shifting table on the Duplimatic permits loading one side while parts are being automatically molded on the other side.

Cord Plug and Insert Molding is easily done on the Moslo 3-ounce Duplimatic.



The Moslo Model 75-4 ounce and the 74-2 ounce are completely automatic plastic injection molding machines. Either model used in conjunction with the Duplimatic makes an ideal combination for insert molding.

ANNOUNCING

The most advanced injection molding machine—the ALL NEW

Moslo Model 12-275

8 to 12 ounces with pre-plasticizer. Watch for complete details to be announced soon.

MOSLO
MACHINERY COMPANY
2446 Prospect Ave. • Cleveland 15, Ohio

MOSLO—The NAME for the world's fastest molding machines

SEE MOSLO EQUIPMENT IN AUTOMATIC OPERATION IN BOOTH NO. 210 AT THE PLASTIC EXPOSITION

Another example of FIBERITE at work...

HIGH IMPACT STRENGTH
This fabric reinforced melamine, Permelite, features an impact strength (ft. lbs. per inch notch, side) of 1.05.

COLOR FAST
Available in pastel shades as well as gray, black or tan; meets strict design demands for long-lasting, handsome appearance.

TOUGH HARD SURFACE FINISH (Hardest of all plastics)
—a cost-saving characteristic that makes Permelite ideal in numerous applications from Teletype keyboards and housings to heavy duty institutional dishware.

IMPERVIOUS TO SOLVENT STAINS AND HEAT
These extra benefits of Permelite products pay big dividends in keeping maintenance problems at a minimum.

PERMELITE (*Fiberite's melamine*) PLAYS KEY ROLE IN THE TELETYPE PRINTER

That intriguing, prolific informant . . . the Teletype Printer . . . rushes printed messages throughout the world at speeds up to 100 words a minute. Its strenuous, around-the-clock role in vital communications calls for highest equipment reliability . . . that's why the Teletype Corporation and one of their plastics molders, Imperial Molded Products, use Permelite.

Permelite (Fiberite's reinforced melamine) fills a bill of rigid specifications for the Teletype's keyboard panel and keyboard housing. Product requirements of high impact strength, color fastness, tough, hard surface finish and imperviousness to heat and solvent stains, as illustrated, plus molding qualities that help achieve efficient production are typical of performance by Fiberite compounds.

Why don't you find out how Fiberite's versatile reinforced melamine or phenolic formulations can help you? Write, wire or phone for complete data!

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DETROIT OFFICE: Fred C. Grosius, 380 Hilton Rd., U. 8-6071
CHICAGO OFFICE: Railway Exchange Building, Michigan Ave. at Jackson Blvd., HA. 7-1164
WESTERN OFFICE: Riverdale Plastics, 8510 Warner Drive, Culver City, Calif., TE. 0-7733
CANADA: The Bakelite Co., 40 St. Clair Ave. E., Toronto 7, Ontario

PRODUCT DESIGNER AND MANUFACTURER: Teletype Corporation, Chicago, Illinois.

MOLDER: Imperial Molded Products Corporation, Chicago, Illinois.

MOLDING COMPOUND: Fiberite's fabric reinforced melamine No. 2015, Tradename Permelite.

THE FIBERITE CORPORATION
Manufacturers of Plastic Molding Compounds
Main Office: WINONA, MINNESOTA • Phone 2316

give your plastic products the benefit of the

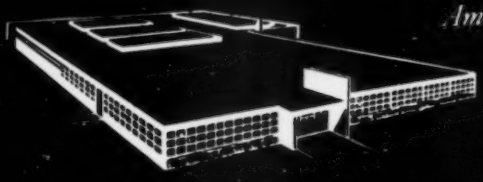
MAKRAY OK

Precision | *Molding*

The Makray "OK" on your product is the result of a unique system of engineering, designing, molding and assembly room techniques that result in the best in plastics technology. But, while we are unique in the quality of painstaking craftsmanship and inspection that we apply to your products, we are completely competitive in price. Whether we originate the design or work from yours our objective is the same: To give you a plastic product that looks better, works better and sells better.

When you are in or near Chicago come out and visit us. You'll see why results are finer from America's finest injection molding plant. Or, call or write today for the complete story on the Makray "OK"

Colorful Ring Toss game economically molded of polystyrene



America's finest, most modern plastic molding plant

- 24-hour operation assures speedy delivery
- 26 latest Hi-speed presses . . . 8 oz. to 60 oz. capacity
- Precision molds designed and built in our own shop
- Complete engineering service to serve you . . . save you money

MAKRAY MANUFACTURING COMPANY

Precision Plastic Molders

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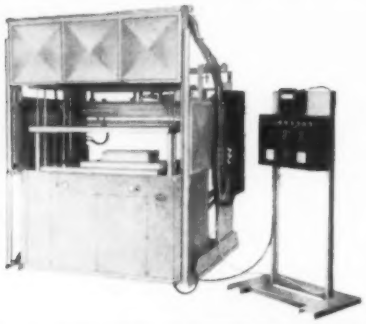
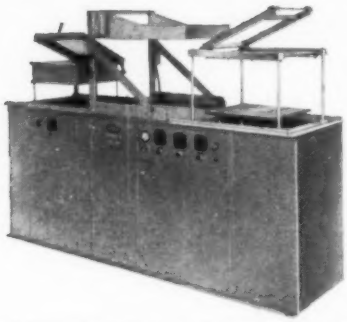
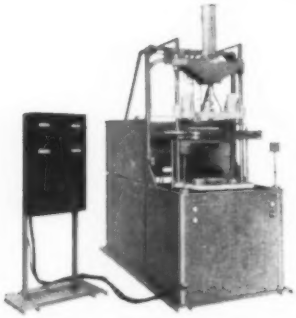
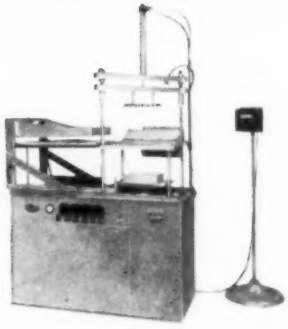
VACUUM, DRAPE, PLUG and PRESSURE FORMING



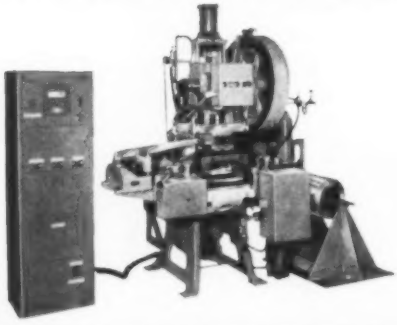


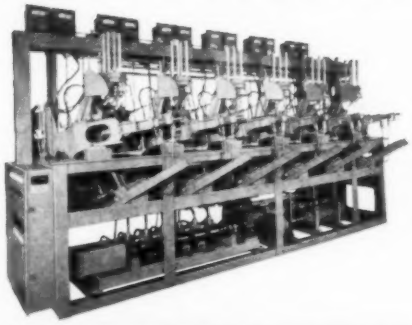
SKIN and BLISTER PACKS . . . EMBOSSED SIGNS





TRANSPARENT TRAYS and LIDS . . . SPECIALTIES





EMHART...PLASTICS FORMING...AND YOU

Plastics forming is moving fast and opening new profit opportunities as it advances. Emhart is uniquely qualified to help you focus clearly on these opportunities. As manufacturers of the most extensive line of sheet plastics forming equipment, we offer you unequalled experience and scope in planning, modernizing or expanding your facilities.

In addition, through our demonstration and service center, you can personally observe our equipment in action . . . discuss materials and their application with our engineers . . . even test-run product ideas. These same facilities are also available for personnel training.

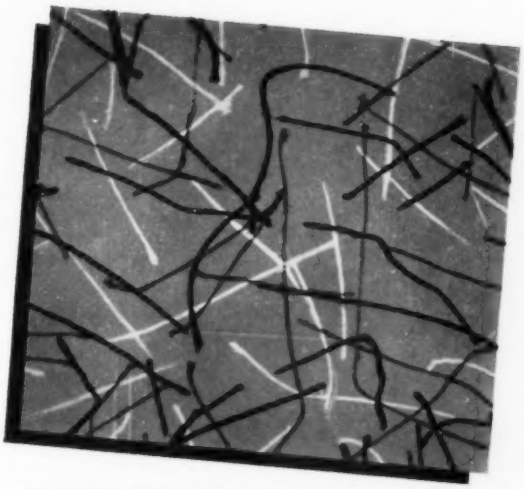
With plastics forming offering so many new profit opportunities, you owe it to yourself to check what Emhart can do to help you realize them. Write for literature . . . or better yet come see us.

EMHART
MANUFACTURING COMPANY
Plastics Forming Machinery
STANDARD-KNAPP DIVISION
Portland, Connecticut

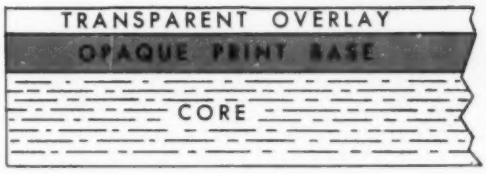
■ ***SEE US AT PLASTICS SHOW - BOOTH 644-646***

HURLBUT now offers OVERLAY, PRINT BASE and CORE STOCK

HURLBUT can now supply all the paper components of a decorative laminate, through manufacture of OVERLAY and PRINT BASE at their South Lee mills and of CORE STOCK at other mills of The Mead Corporation.



TO YOU THIS MEANS:



SIMPLIFIED PROCUREMENT

Complete laminate paper requirements from one reliable source.

INCREASED Manufacturing Facilities for Your Requirements

Continued operation of Willow Mill at South Lee, Mass. Operation of complete new Laurel Mill at South Lee, Mass. Manufacturing facilities of mills of The Mead Corporation.

FASTER DELIVERY SERVICE

Through new warehousing facilities established in Dayton, Ohio, plus inventory stock at South Lee mills.

HURLBUT LAMINATING PAPERS ***are the acknowledged standard of the industry. They exemplify the utmost obtainable in cleanliness, uniformity, treatability, and reliability.***

Call* HURLBUT *for:

Alpha or rayon fiber white and colored transparent Overlay • White Overlay with decorative metallic inclusions • Opacified Print Base, white and all colors • Cellulose Industrial Absorbent papers • Inorganic Industrial papers • Synthetic fiber papers • Core Stock paper for decorative laminates.

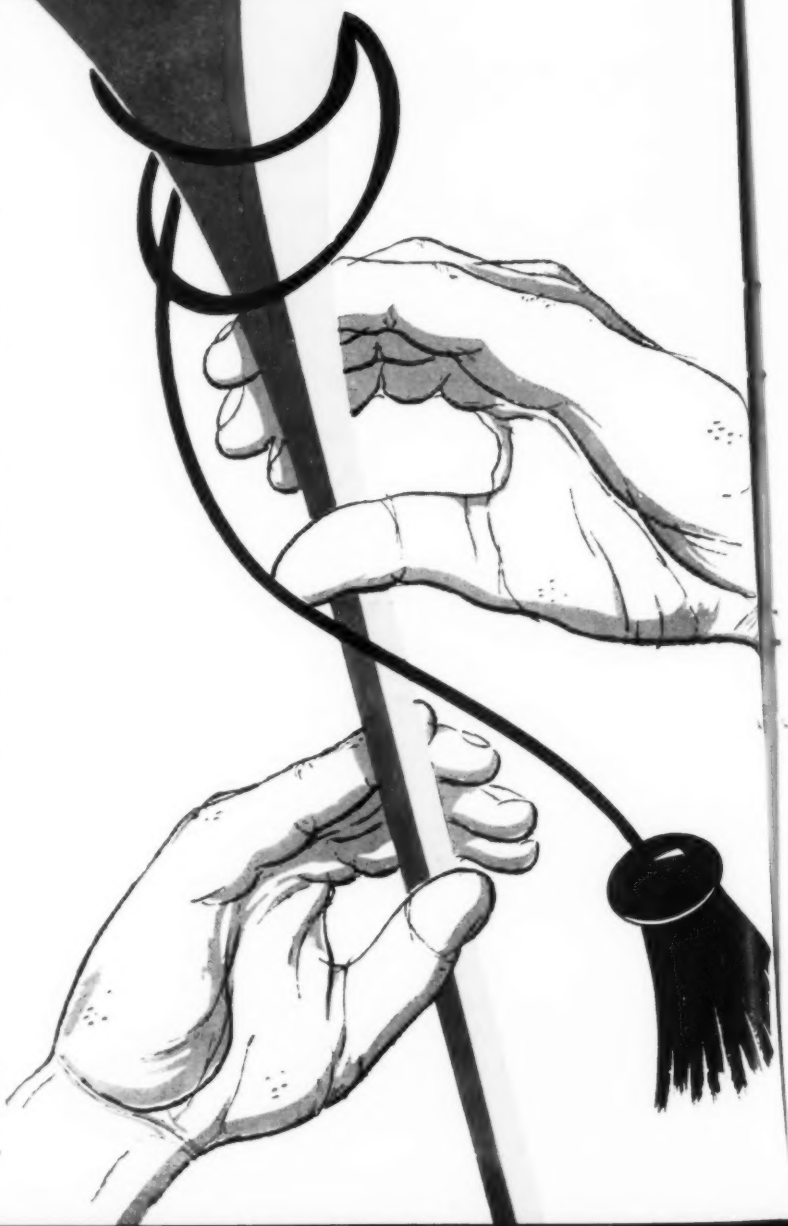
HURLBUT
PAPER COMPANY
SOUTH LEE, MASSACHUSETTS

A SUBSIDIARY OF
THE MEAD CORPORATION

ANNOUNCING...

WITCO FOMREZ® RESINS

NOW AVAILABLE FOR *rigid or flexible* URETHANE FOAMS



Witco's top-performing Fomrez resins are now available in any quantities for compounding urethane foams—flexible or rigid. Fomrez resins have outstanding uniformity...insure foam reproducibility. For the very best in urethane foams, formulate with Witco Fomrez resins. Mail coupon for details.

FOR FLEXIBLE FOAMS

Witco Fomrez No. 50...Witco Fomrez No. 70... Witco Fomrez No. D25-30

For the production of high-quality flexible urethane foams, adaptable to both "one-shot" and prepolymer foaming systems. Widely applicable in industries such as automotive, aviation, furniture, clothing, packaging, bedding, sports equipment, and many others.

FOR RIGID FOAMS

Witco Fomrez No. R-400...Witco Fomrez No. P-420

Foaming systems for producing low to high density foams possessing excellent structural strength, uniform cell structure, heat and dimensional stability. Can be foamed in place by batch, continuous or intermittent machine mixing or spray foaming methods.

Rigid foam uses: thermal insulation (refrigerators, freezers, pipes, tanks, etc.); structural reinforcement (core material for structural sandwich panels, wall panels, etc.); potting or encapsulation of electric components; flotation equipment.

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122 East 42nd Street, New York 17, N.Y.

Please send me details of Fomrez products suitable for production of .....

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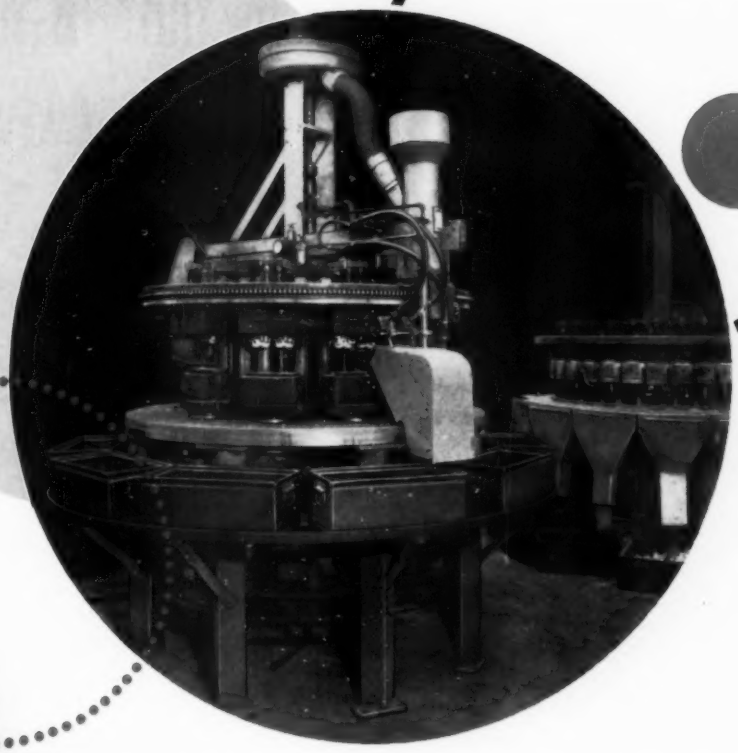


NEBUTTCO

ROTARY PLASTIC MOLDING PRESSES

- **LOW COST, AUTOMATIC CONTINUOUS MOLDING**
- **AMAZINGLY FAST**

NEBUTTCO Rotary Plastic Molding Presses, using thermosetting compounds, bring new economics in the production of small plastic parts. Made with ten or thirty stations, the presses use single- or multiple-cavity molds and continuous rotary operation assures high production.

Originally designed and patented by the General Electric Company, these rotary presses are used for the mass production of molded parts used in wiring devices, and they can be adapted for a wide variety of other plastic products.

By agreement with the General Electric Company, the presses are manufactured in the modern plant of the New England Butt Company, producers of quality machinery since 1842.

The New England Butt Company's experience in building special machinery assures trouble-free operation, and enables us to stand behind the performance of these presses.

Sales and service of the presses are handled by New England Butt Co. Send for descriptive bulletin.

NEW ENGLAND BUTT CO.

Division of Wanskuck Co.

304 Pearl Street • Providence 7, R. I.

Continuous Rotary Operation
10-station press is equivalent of 10 small molding presses, yet occupies floor space of but 2 average presses.

High Production With Low Cost Molds
Eliminates expensive frames and costly multiple-cavity molds. 30-station press produces average of 30 parts a minute with single-cavity molds: 60 parts with double-cavity molds and up to 90 parts a minute with triple-cavity molds.

Flexible
Up to 30 different molds can be used at one time in 30-station press, provided all use same molding compound and require approximately same curing time.

Completely Adjustable
Thermosetting compounds are hopper-fed and precisely metered by drilled plugs in plate, conserving compound and minimizing flash.

Low Maintenance Cost
Low molding pressure greatly reduces possibility of double loading, pin breaking, etc.

Separate Thermostats
Curing temperature for top holders can be set above or below that for bottom holders. Also, three zone thermostats permit varying curing heat for different molds.

Safety Features
Simple screw valve adjusts curing time by changing speed of rotation. If hydraulic system fails, this control instantly shuts down entire press.

A Masterpiece produced by the TRIULZI

Model PL 6/10

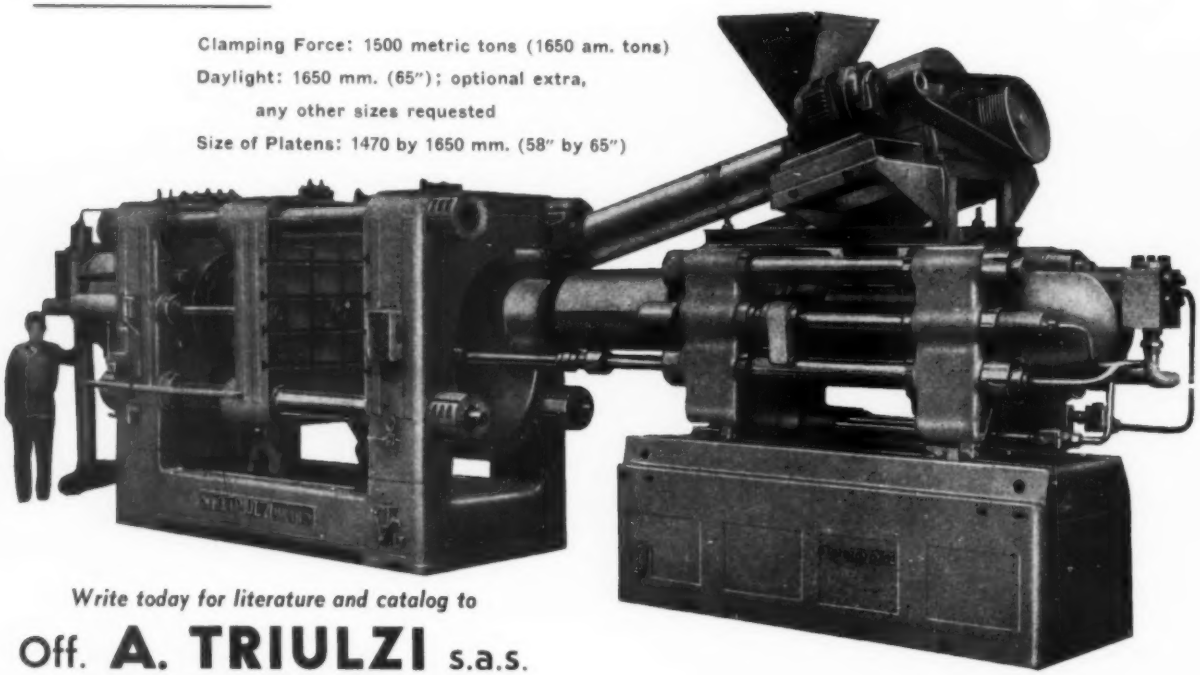
Europe's largest injection molding machine (350 oz.) . . . with preplasticizer and possibility for a wider daylight

PRODUCED FROM LOW PRESSURE POLYETHYLENE

Weight: 8,400 kg. (300 oz.)
Maximum Ø: 750 mm. (30")
Minimum Ø: 550 mm. (22")
Maximum Height: 650 mm. (26")

TRIULZI Model PL 6/10

Clamping Force: 1500 metric tons (1650 am. tons)
Daylight: 1650 mm. (65"); optional extra, any other sizes requested
Size of Platens: 1470 by 1650 mm. (58" by 65")



Write today for literature and catalog to

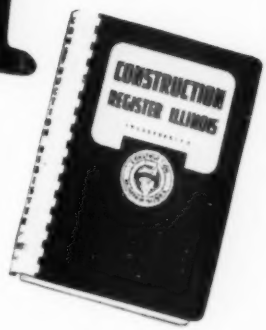
Off. A. TRIULZI s.a.s.
via Vialba 56 NOVATE (Milano), Italy
Telegrams: TRIULZIPRES—NOVATE MILANESE

NIXON THERMOPLASTIC SHEETS IN USE PROVE THEIR QUALITY AND FITNESS

for all methods of forming and fabricating

NIXON RIGID VINYL is expertly formulated to withstand heat, rough handling and has high dimensional stability. Here it creates a dramatic, full-color, illuminated point-of-purchase display. Figures stand 65″ and 45″ high. Vacuum formed by *Majestic Creations, Inc., Woodside, N. Y.*

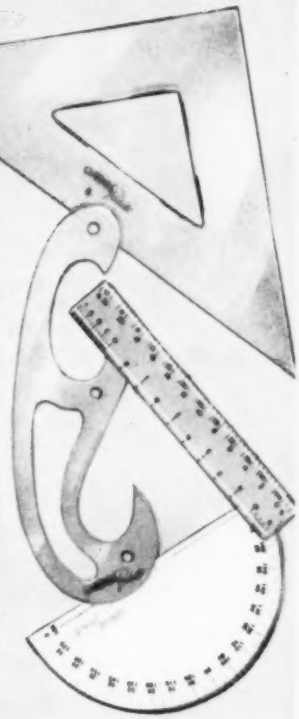
Sturdy, flexible binder covers come in a variety of colors. *General Binding Corp., Northbrook, Ill.*

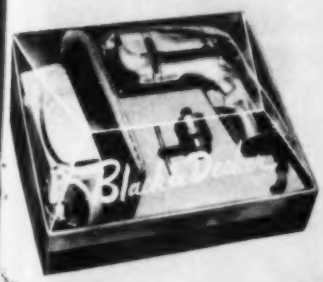


NIXON CELLULOSE ACETATE BUTYRATE is a particularly rugged material. Vacuum formed at very low cost for attractive counter display, butyrate sheet can be relied upon for clarity and protection. *Majestic Creations, Inc., Woodside, N. Y.* Metalized butyrate creates a shiny "gold" replica of lipstick case. *Coating Products, Englewood, N. J.*

Used for clear, precise drawing instruments, it will not craze or deteriorate with age. *Cardinell Products, Montclair, N. J.*

NIXON HIGH-IMPACT STYRENE, frame and base of this display, was specially formulated for well-defined printability and embossing.



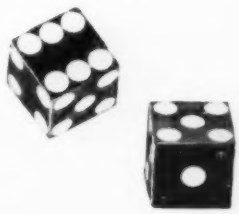


NIXON CELLULOSE ACETATE provides visibility as well as protection and adds sparkling sales appeal to quality power tools. Vacuum formed by *Klear-Form Pak, Inc., Baltimore, Md.*

Also available in a whole wide range of smart colors and combinations for lustrous ophthalmic frames. *American Optical Co., Southbridge, Mass.*

NIXON CELLULOSE NITRATE to the ophthalmic industry is as important as ever for its many beautiful effects and excellent fitting characteristics. Here are examples of classic and fashionable styles by *American Optical Co., Southbridge, Mass.*

For precision dice nitrate sheet is standard material.



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Phone — New Brunswick Charter 9-1121, Metuchen Liberty 9-0200, New York Ext. WOrth 4-5290. **Chicago Office,** 510 No. Dearborn St., Michigan 2-2363. **St. Louis,** C. B. Judd, 3687 Market St., JEfferson 5-8082. **Cleveland,** E. H. Alexander, 20605 Kings Highway, Wyoming 1-2863. **Leominster, Mass.,** C. A. Dovidio, Phone 7-2120. **Canadian Distributor:** Crystal Glass & Plastics Ltd., 130 Queens Quay East, Toronto, Ontario.

FELLOWS "12-350" offers molders

SPEED — For the first time, here is an intermediate size machine that cycles faster than many smaller machines for those large area, thin wall parts! The "12-350" dry cycles at 600-800 cycles per hour.

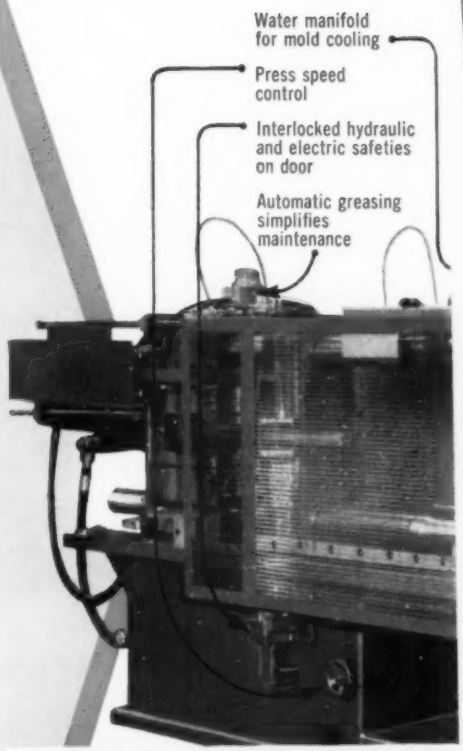
HIGH CAPACITY — Make shots up to 20 ounces—33 cubic inches—with the standard Pre-Pac device which double-strokes the plunger during press dwell.

FULLY AUTOMATIC — One man can supervise three or more machines while they operate themselves! Precision controls are grouped for easy setting and checking. Optional equipment includes Recycle Timer, Air-Blast, Dual Injection Pressure Control, Low-Pressure Mold Closing Safety Device and Counter.

EASY SET-UP — Press retracts from the heating cylinder for easy hot-end set-up and purging. Mold height (10" to 24") and clamping adjustment set easily and accurately through a single control shaft.

AND MORE FEATURES—

The 12-350 with 44" daylight and 20" stroke takes mold bases up to 20" by 33"... toggles exert clamping pressure of 350 tons...ball joint adapter for injection nozzle simplifies alignment of sprue bushing and heating cylinder... hydraulic and electric interlocks on safety doors ...and many other Fellows high-production features!


Water manifold for mold cooling
Press speed control
Interlocked hydraulic and electric safeties on door
Automatic greasing simplifies maintenance

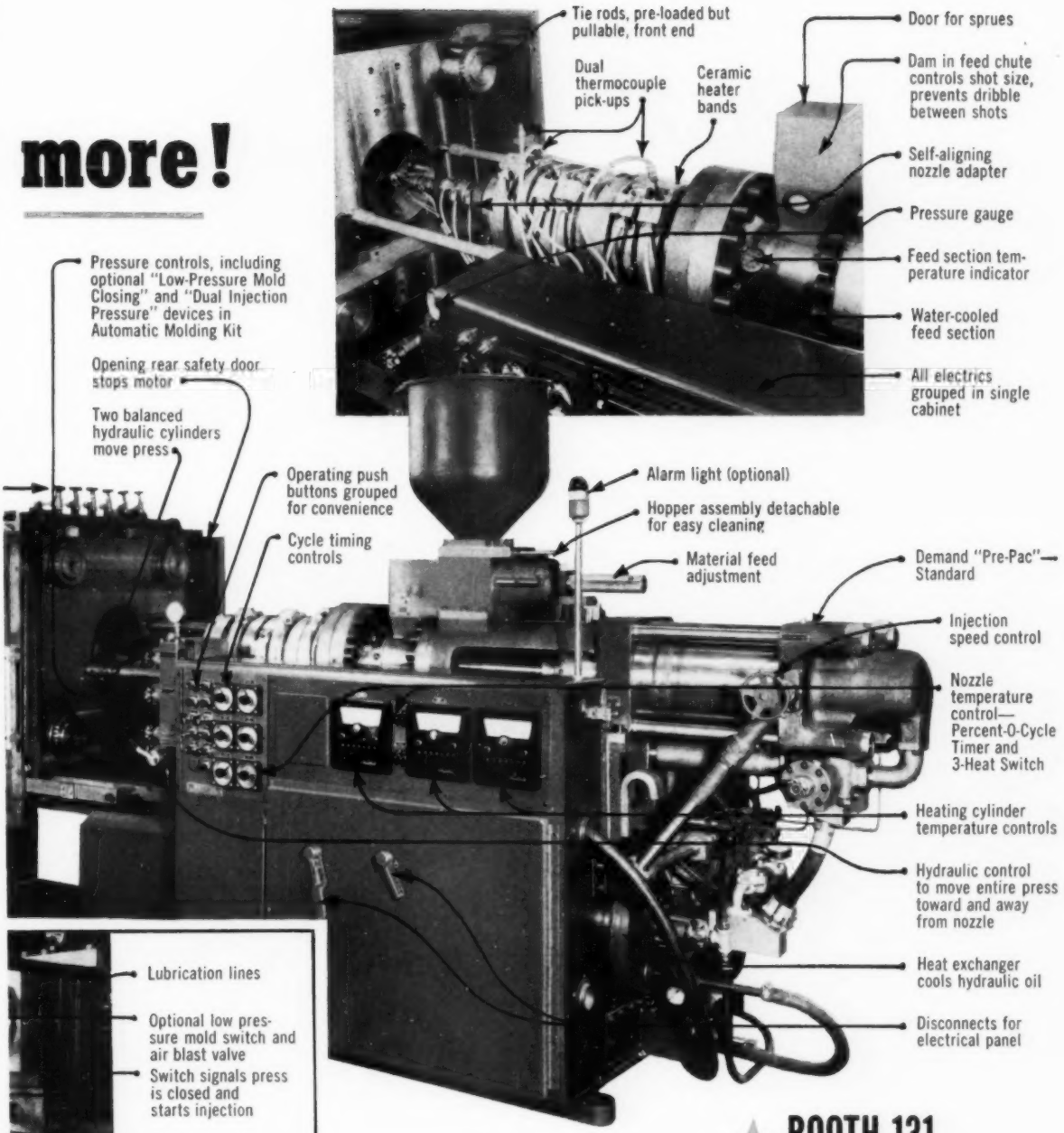
Ask your Fellows Representative for complete information about the 12-350 and other Fellows Injection Molding Machines.

SOCIETY OF THE PLASTICS INDUSTRY · SPI

THE FELLOWS GEAR SHAPER COMPANY
Plastics Machine Division

Head Office and Export Department: Springfield, Vermont • Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich.

more!


Tie rods, pre-loaded but pullable, front end
Dual thermocouple pick-ups
Ceramic heater bands
Door for sprues
Dam in feed chute controls shot size, prevents dribble between shots
Self-aligning nozzle adapter
Pressure gauge
Feed section temperature indicator
Water-cooled feed section
All electrics grouped in single cabinet
Pressure controls, including optional "Low-Pressure Mold Closing" and "Dual Injection Pressure" devices in Automatic Molding Kit
Opening rear safety door stops motor
Two balanced hydraulic cylinders move press
Operating push buttons grouped for convenience
Cycle timing controls
Alarm light (optional)
Hopper assembly detachable for easy cleaning
Material feed adjustment
Demand "Pre-Pac"— Standard
Injection speed control
Nozzle temperature control— Percent-O-Cycle Timer and 3-Heat Switch
Heating cylinder temperature controls
Hydraulic control to move entire press toward and away from nozzle
Heat exchanger cools hydraulic oil
Disconnects for electrical panel

Lubrication lines
Optional low pressure mold switch and air blast valve
Switch signals press is closed and starts injection
Adjustable side knock-out with press speed and stroke length control (optional)
Heavy duty trunnion bars for positive press alignment on opening and closing
One-point die height adjustment

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International Amphitheatre
CHICAGO

Fellows

injection molding equipment

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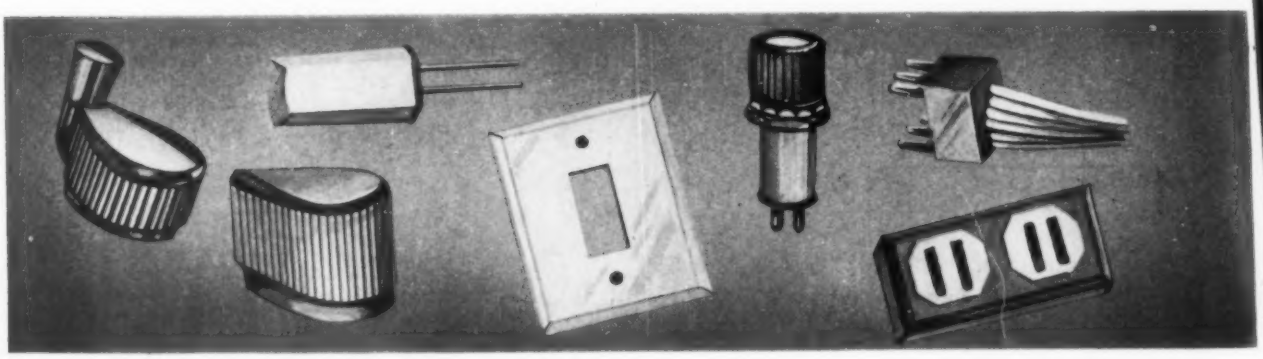
5 years of research teamwork pays off!

NOW 1010 THE NEW LOW COST FILLER FOR UREA MOLDING COMPOUNDS

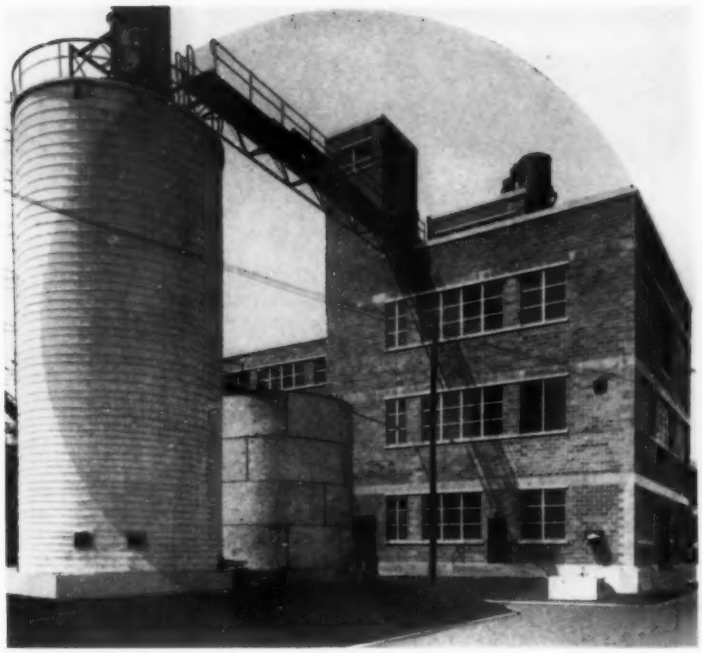
Although the superior properties and low cost of wood-filled urea have made it a favorite with European molders for several years, quality control difficulties have kept these ureas from being successfully produced in the U. S. until now.

Nearly five years ago, Wilner, with the steady help and guidance of the Plastics and Coal Chemicals Division, Allied Chemical Corporation, began a difficult and complex research project to develop 1010, a wood flour of the required purity, light clear color, low acidity and uniformity for urea molding compounds. The development of high purity 1010 has opened new markets for urea molding materials. 1010 is now being used in Allied's Plaskon — produced in the magnificently compact plant pictured to the right. The Wilner Company was also able to provide helpful recommendations in the design and construction of the wood flour handling and storage equipment for this new plant. Wilner is understandably proud of the part it has been able to play in helping the Allied Chemical Corporation to make this new and better urea available to American molders.

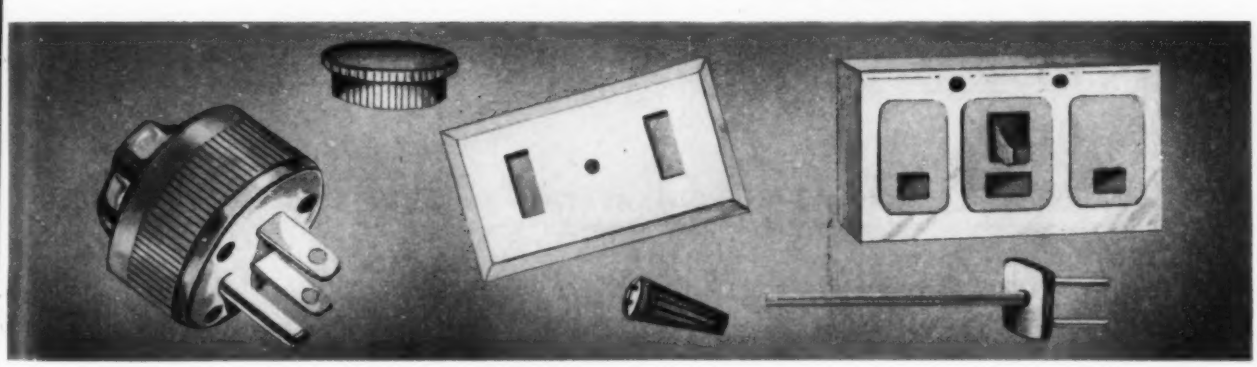


Superior properties at lower cost

The panel above illustrates some of the applications in which wood-filled urea is now offering improved characteristics at lower cost. The new urea offers superior electrical properties, scratch resistant non-electrostatic surfaces, and resistance to common houshold chemicals, combined with color fastness and excellent working characteristics — smooth feeding for high speed forming and automatic molding operations, and less mold wear.



THANK YOU, PLASKON! The only plant in the United States for making wood-filled urea compounds opened at Edgewater, New Jersey, this Fall. Shown above is the new plant of the Plastics and Coal Chemicals Division, Allied Chemical Corporation. Though only 60 feet by 60 feet (with a 60,000 square foot warehouse), extremely efficient production techniques will allow an annual output of the new wood-filled urea (Plaskon) in the millions of pounds. The new plant will use a special grade of very high purity wood flour developed by the Wilner Wood Refinery especially for Allied's requirements.



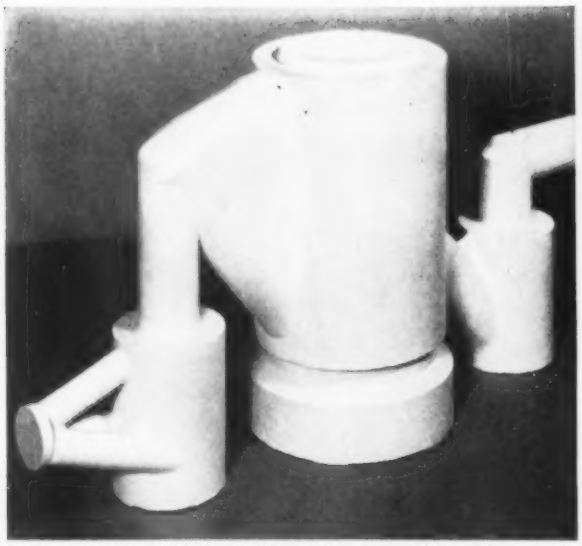
Can Wilner research help you?

The same research facilities which produced 1010 are available to you. If you have a problem involving wood refining or would like to learn more about our products, why not phone or write and tell us.

WILNER WOOD REFINERY

A DIVISION OF WILNER WOOD PRODUCTS COMPANY

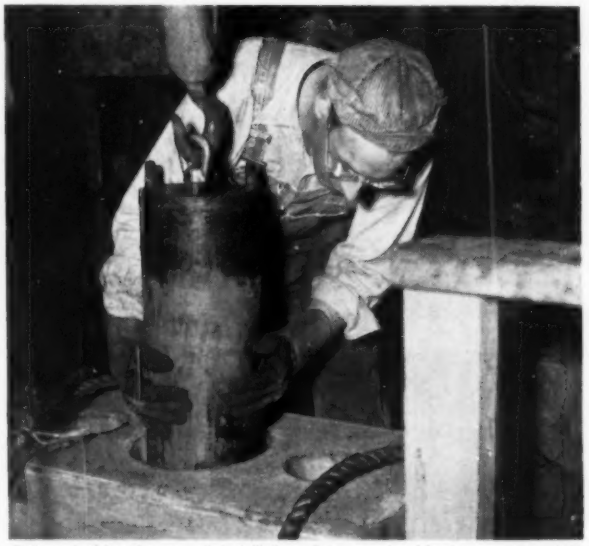
HOME OFFICE AND REFINERIES AT NORWAY, MAINE PHONE PIlgrim 3-6361



To shape the inside of the bromide-bromine liquor pump block, a form is made of plaster of Paris and Styrofoam®.

Dow Epoxy Resin 331 (casting formulation supplied by Ren Plastics, Inc.) is poured over the form and hardens.

The plaster of Paris and Styrofoam material in the form is broken up and removed.



Main part of bromine pump is installed, ready to operate without wear or corrosion!

Dow Epoxies help stop corrosion for chemical processors

This corrosion-free pump block adds another to the list of success stories made possible by new, pure Dow Epoxy Resins.

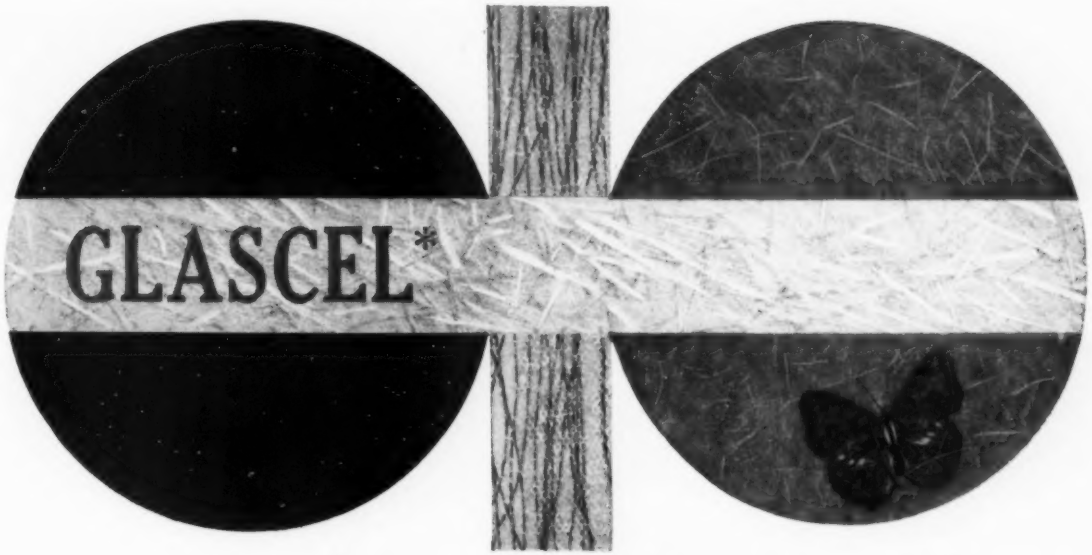
For years the main parts of bromide liquor pumps have been made with machined soapstone. Performance was inconsistent; the slightest crack or seam proved disastrous. But now Dow Epoxies open a new era of efficiency and economy for the chemical processing and corrosion fields. Easily cast to shape without costly machining, the epoxy pump blocks are impervious to the chemicals involved and free from the internal flaws of soapstone.

Have you a corrosion problem where Dow Epoxies may help? Write for information and technical help. Dow is a basic producer of the raw materials used in epoxy production. In this way Dow provides raw materials with optimum properties to produce superior resins, to control quality carefully and to provide a narrower range of specifications in the finished resin—so necessary to uniform performance. For complete information and technical data on Dow Solid and Liquid Epoxy Resins, consult your Dow sales office. Or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Coatings Sales Department 2265H.

EPOXY T.M.

YOU CAN DEPEND ON DOW

Solving unusual problems with Riegel papers



new glass reinforcing material made on a paper machine!

...for things like decorative plastic laminates, electrical and structural parts...and what do you make?

Not long ago, a laminator mentioned need for a new glass reinforcing material with better uniformity . . . and lower cost . . . than non-woven types then available. Ideally it would be a mixture of glass and something less expensive, using just enough glass to give the strength required by each job.

Why not *paper* made with glass? Lots of off-beat fibers have been made into paper on Riegel's versatile machines. And Riegel had wide experience with impregnations. Our researchers went to work.

Result: an idea-provoking new material called "Glascel*." It can be tailor-made for almost any need with 5 to 90% of ½" glass fibers, mixed with a wide choice of papermaking fibers. It has remarkably even weight distribution, and is supplied in almost any weight, widths up to 65".

Typical uses: architectural panels, room dividers, awnings, shatterproof enclosures, trays, mats, coasters, lampshades, signs. Electrical and structural parts, too, such as tube winding, electrical laminates, printed circuits. Interested?

Riegel specializes in developing and manufacturing ***technical papers that solve problems.*** More than 600 kinds of papers have already been produced on our 14 machines. We'll be glad to give you a run-down... or tell us your problem...

*TM

OVER 600 RIEGEL PAPERS

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How to reduce your mold costs

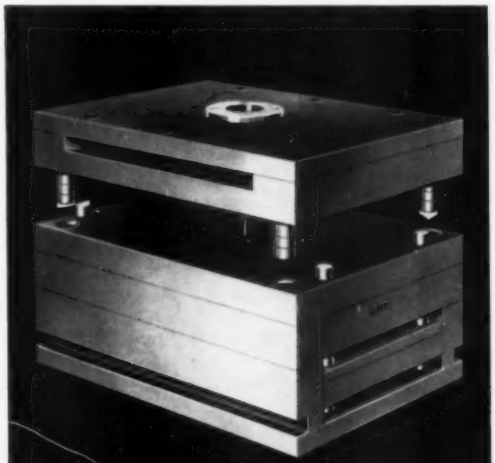
D-M-E STANDARD MOLD BASES can reduce your mold costs in the design stage . . . during construction . . . and throughout the operation of the mold.

Mold designers can reduce drawing board time by using D-M-E's full-scale Master Layouts, which provide locations of leader pins, return pins, screws and other standard details. Complete catalog specifications and prices on 31 standard sizes—up to $23\frac{3}{4}$" x $35\frac{1}{2}$"—eliminate guess-work in estimating the cost of the mold.

But your savings don't end there: Moldmaking time is turned into dollars earned, because all the plates in the assembly are precision ground—flat and square—ready for the moldmakers' layout and machining (pictured below). The exclusive inter-changeability of all D-M-E plates and component parts give you the added saving of immediate replacement in case of emergency.

For the molder, the use of higher grades of CLEANER steel in D-M-E Mold Bases means added strength and longer mold life. And D-M-E's range of standard sizes fit into *more* molding machines.

Start saving now . . . with D-M-E STANDARD MOLD BASES!



Over 1000 D-M-E STANDARD MOLD BASES are always IN STOCK at local D-M-E Branches ready for IMMEDIATE DELIVERY.

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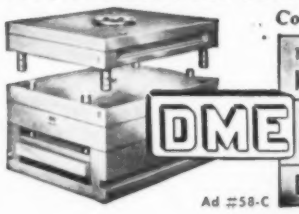

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MERCURY DARK RED Lithopone No 510
MERCURY MAROON Lithopone No. 520

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The Harshaw Chemical Company
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YOU CAN GET better laminated and molded products three ways with Pittsburgh Fiber Glass. ○ *First*—PPG provides you with a quality, uniform reinforcement of exceptional dimensional stability and dielectric strength; it's fire-resistant, heat-resistant, odorless. ○ *Second*—PPG can supply you with quality YARNS in any twist or ply, in all standard sizes . . . ROVING in a variety of finishes and end counts wound to your requirements; it's static-free, ideal for use in preforming or spraying . . . CHOPPED STRAND in lengths of ¼" and up, packaged for convenient handling; its uniformity helps cut rejects. ○ *Third*—PPG offers you technical help through free trials made in your own plant to show you how Pittsburgh Fiber Glass can help you produce better end products. Call your nearest PPG Sales Office or write Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pa.

A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, Minneapolis, New York, Philadelphia, Pittsburgh and St. Louis

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PITTSBURGH PLATE GLASS COMPANY

it begins here at PCC

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PCC blends, compounds and colors *only virgin materials* to the highest finished quality available anywhere.

PCC assures you full time attention of skilled plastic technicians to handle orders to your specifications

Your current needs for polyolefins (polyethylene, linear polyethylene, polypropylene—blends of all these) are our most immediate concern. May we counsel with you on your requirements?

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Emulsion and suspension polymers for general purposes.
Special grades for dielectric uses, unplasticized extrusion and calendering.
Paste-making PVC resins (plastisols).
General purpose copolymers.
Special grades for LP records, vinyl asbestos floor-tiles, rigid opaque, tinted or clear sheeting, for vacuum forming.
Special copolymers designed for solution applications.

Solvic is supplying PVC and copolymers in large quantities to plastic users throughout the world. In addition, Solvic manufactures PVC compounds and colour concentrates (masterbatches) under the trade name, BENVIC.

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SOLVIC S. A. 244, RUE DE LA LOI - BRUSSELS (BELGIUM)

Affiliate companies and works in Austria, Brazil, France, Germany, Italy and Spain.

BAHAMA BLUE LAKE BL-4526

Lowers Color Processing Costs . . .

Laboratory comparison tests clearly demonstrate the superiority of Suco's new BAHAMA BLUE Lake BL-4526 over typical Phthalocyanine blue lakes and toners. In obtaining the results shown below, each pigment was incorporated into vinyl sheeting and given three minutes milling time on a two-roll mill. BAHAMA BLUE Lake BL-4526 displayed an exclusively outstanding property of fast dispersion in many usages, eliminating expensive requirements of pregrinding or dispersing, insuring uniform production from batch to batch, and yielding a maximum tinting strength. This minimum time requirement considerably reduces color processing costs.

A Typical Phthalocyanine Blue Lake

A Typical Phthalocyanine Blue Toner

BAHAMA BLUE LAKE BL-4526

25% crystallizing-type Phthalocyanine Blue combined with 75% Calcium Carbonate

For full details on this new Bahama Blue Lake BL-4526, consult your SUCO *representative*, as close to you as your telephone.

Standard Ultramarine & Color Co.

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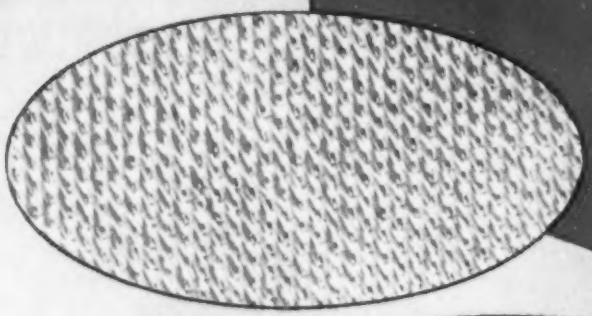

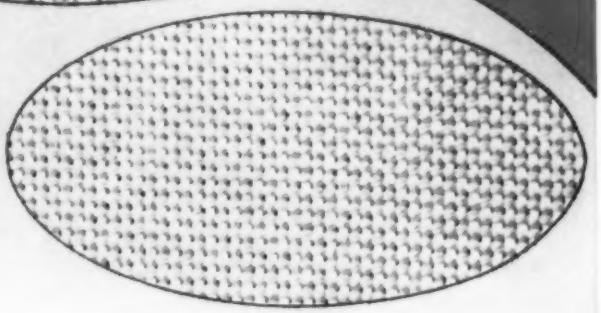

Wherever you need maximum strength per pound of reinforcement . . . high standards of quality . . . uniformity in weight, weave and thickness . . . contact FLIGHTEX for fast service.

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FLIGHTEX FABRICS, INC.

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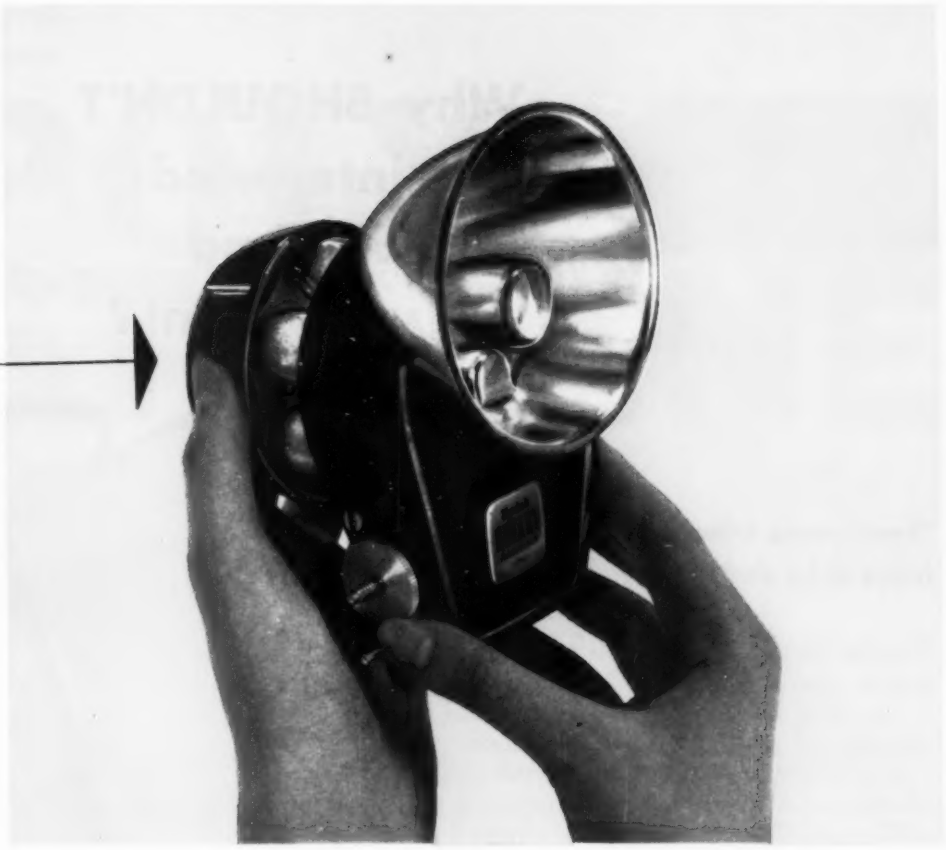
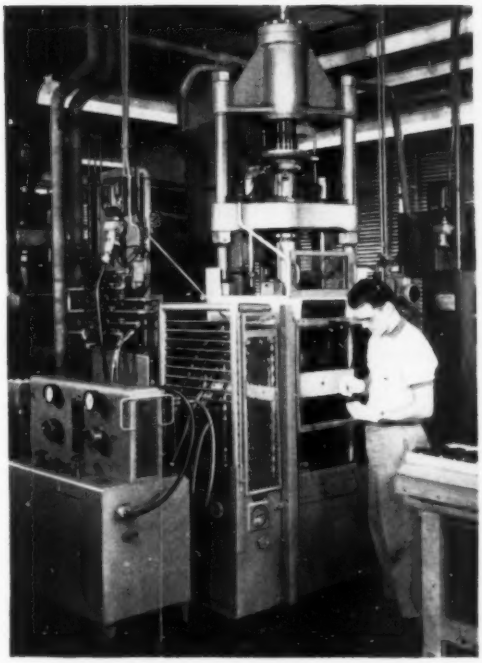


Kodak's Flasholder features a 6-shot bulb magazine which, when rotated brings a fresh bulb into position. It is molded of thermoplastic in a two-cavity mold.

Turrets for new Kodak Flasholders injection molded on Watson-Stillman machine



You might be one of thousands of camera fans who own a new Kodak Rotary Flasholder. If so, you've gotten a close look at a nice piece of injection molding.

The turret-type bulb magazines for these flashguns are injection-molded at Kodak on a Watson-Stillman 6-ounce vertical machine. It delivers precise, uniform-quality molding that easily meets Kodak's high requirements – plus the volume and economy so necessary in a product of this type.

Watson-Stillman equipment has been used at Kodak's Apparatus and Optical Division for over five years. Their experience is typical of the many molders throughout the country, using Watson-Stillman machines.

Write for full details on Watson-Stillman injection molding machines. Capacities range from 5 to 500 ounces.

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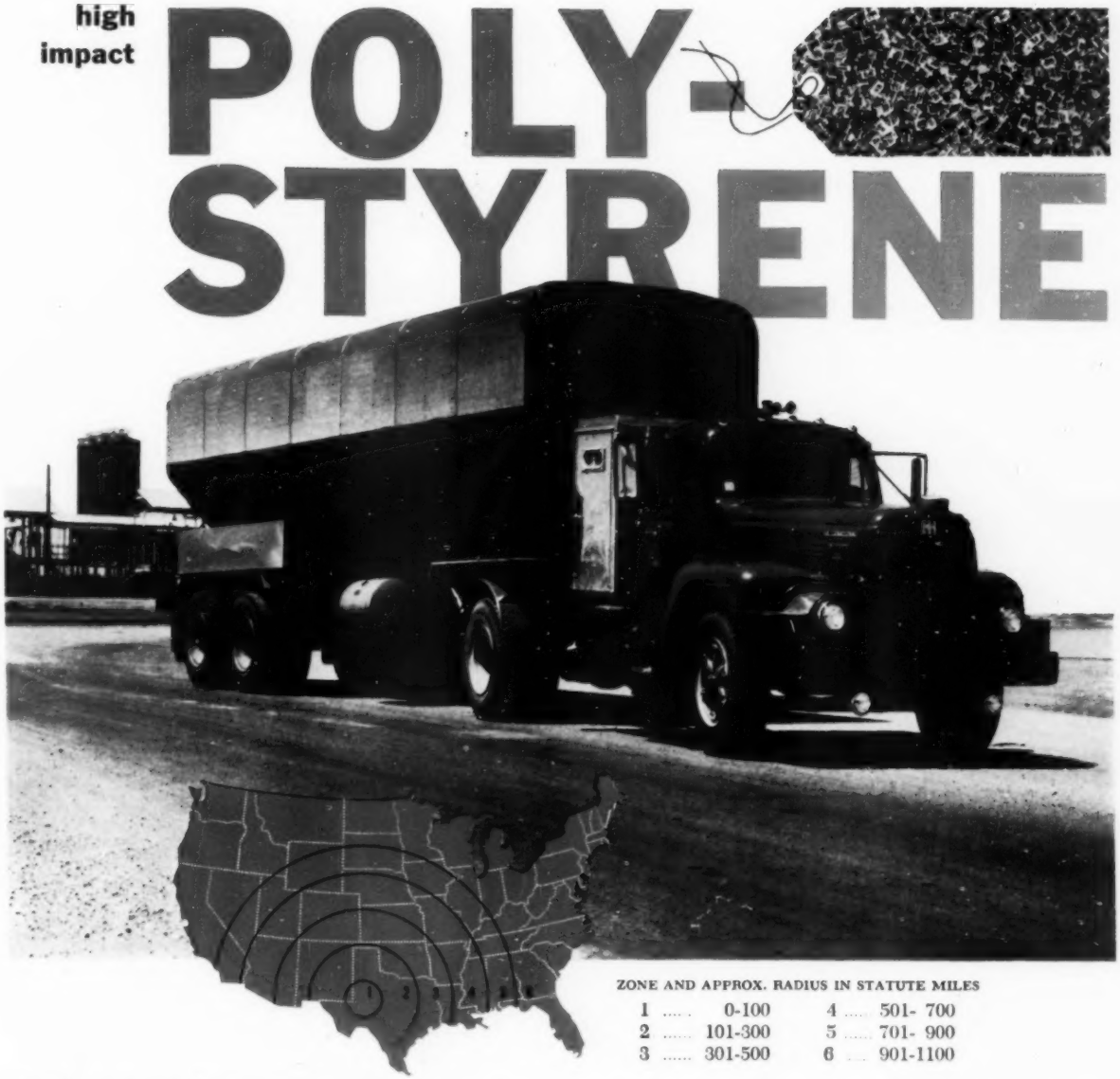

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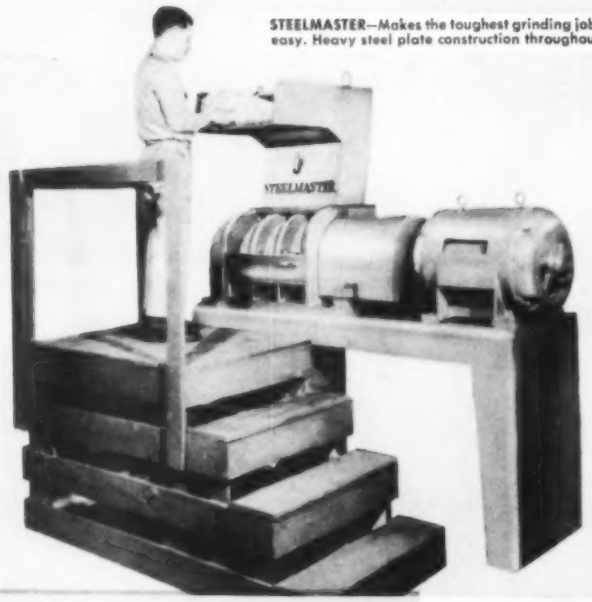

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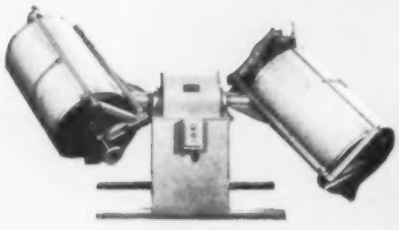

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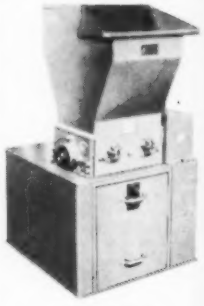
Floor level loading. Accommodate 28" to 33" drums. Ball bearing equipped. Extra heavy steel construction throughout.



MARVEL SERIES GRANULATOR
Models with capacities from 75 to 500 pounds an hour. Constructed of steel.

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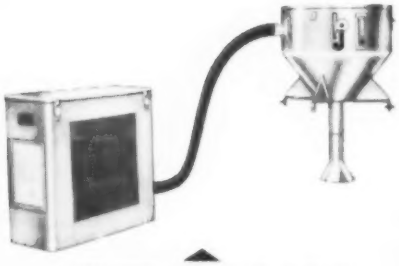
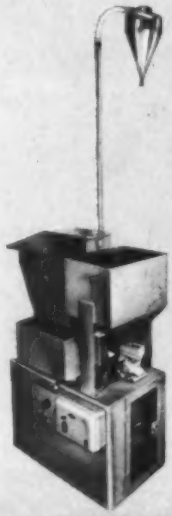


HEATER-DRYER (HOPPER ATTACHMENT)
Disperses moisture and preconditions material. Helps eliminate rejects and increase production. Steel or Stainless Steel Construction.



BLENDER-LOADAMATIC
Mixes virgin material with regrind as the regrind is generated, then loads mixed material into extruder or molding machine hopper.

Performance counts . . . and, on-the-job, B&J Granulators outperform all others of comparable size and cost. For beside-the press, you can't beat B&J Marvel Series Granulators —built entirely of steel with capacities up to 500 pounds an hour. For large volume batch grinding or for handling the toughest thermoplastics, your best buy is a B&J Steelmaster Granulator. For intermediate requirements, there are many other models to choose from. Compare performance . . . compare construction . . . compare cost—you'll see why Ball & Jewell has been the leader in granulating machines for more than 60 years.

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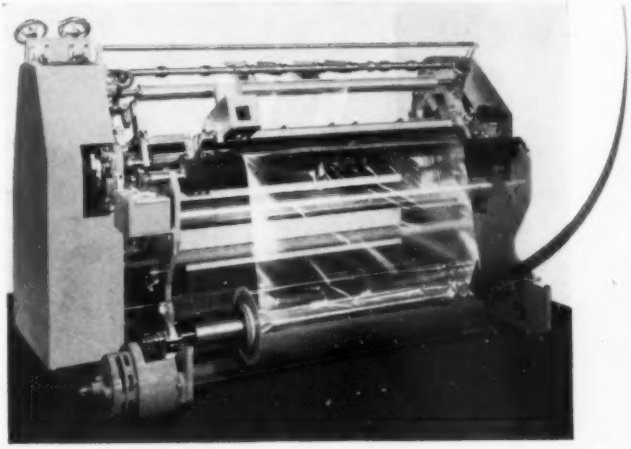

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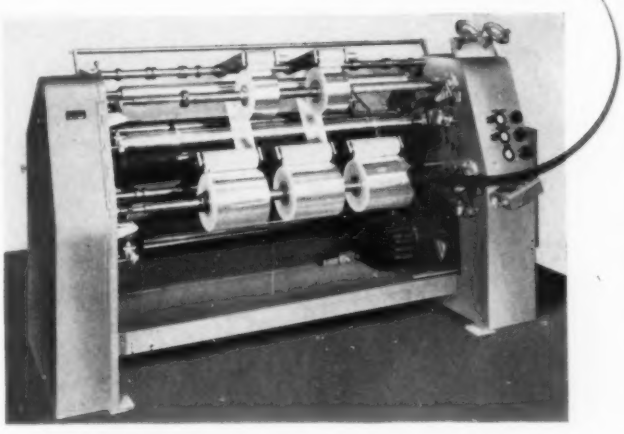

THE MODEL 635 SLITTER-REWINDER

with the

NEW LOW COST MODEL 804 AUTOMATIC EDGE GUIDING UNWIND

featuring the latest in tension indicating units

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- **RAZOR BLADE**
- **BURST**
- **SCORE CUT***

Our latest development, Model 804 Unwind, incorporates all the features of the larger 704 Unwind Stands. It is mounted integral with the slitter, requiring no additional floor space or mounting. The 804 brings you, with no loss of accuracy, a more compact unit at approximately half the cost of the larger unit.

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Change over from shear cut to razor blade or to burst takes only a matter of minutes, giving complete versatility of slitting methods for handling a wide range of materials.

*On special applications score cut can be provided.

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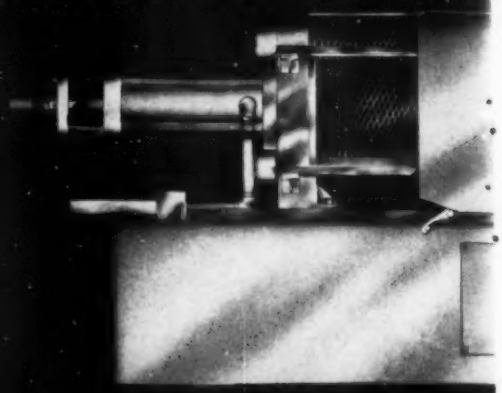
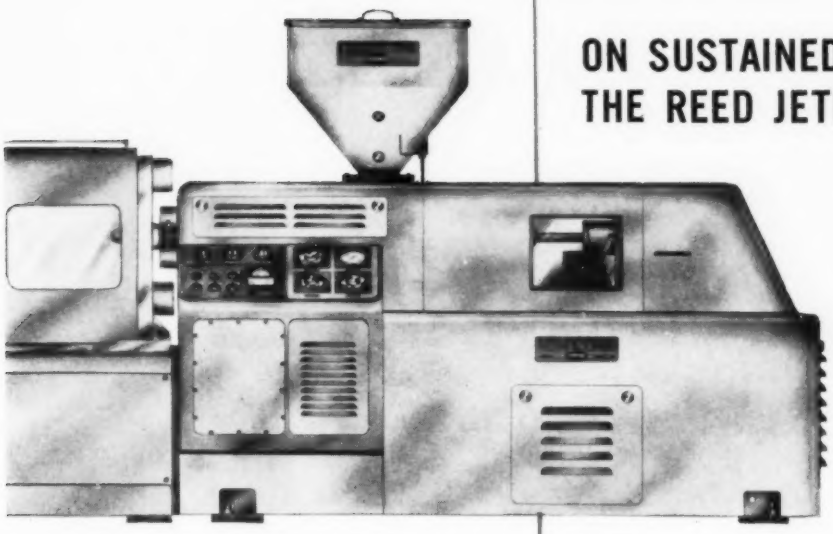
See it at the plastics show . . .



REED JETFLO

. . . a revolutionary new machine— the greatest single development that thermoplastic molding has yet seen!



ON SUSTAINED PRODUCTION RUNS THE REED JETFLO HAS...

- **molded thin-wall containers on a *1.7-second*, fully automatic cycle.**
- **run a wide variety of standard injection molds up to 50% *faster*, with greatly improved product quality.**
- **positively proved drastic savings in material cost.**

Here, in one machine, is a process that will astonish the plastic molding industry. Offered only by Reed-Prentice, the REED JETFLO effectively uses the principles of extrusion and injection molding by combining the superior plasticizing of an extruder with the speed and versatility of an injection molding machine.

The JETFLO, 7 years in development and testing, is *now* ready to deliver the advantages shown above — *plus* many more, some almost unbelievable.

The JETFLO 4/6 oz. machine consists of a 175 ton toggle mechanism and platens, coupled to a 100 lb. per hour, hollow screw extruder. This screw method plasticizes at lower, more uniform temperatures, results in higher molding speeds and improved product quality. Continuous moving and compounding doesn't allow material to orient itself in the chamber. A plunger in the extruder's bore acts against plasticized material located in the forward end of the hollow screw, injecting it into the mold in a spraying effect. Positive and continuous speed control of the screw and plunger afford accurate control of shot size and inventory.

The REED JETFLO also features complete and uniform color blending using dry coloring without premixing.

Convince yourself that the JETFLO process is the most important development now available to the plastic molding industry. See it in operation at Reed-Prentice Booth 408 during the National Plastic Exposition, November 17-21. Talk to the REED Sales Engineers at the booth. They will prove all the claims made for the JETFLO, show you many features that haven't been mentioned here.

Don't miss the REED JETFLO. *It can mean better, faster, more profitable molding for you!*

See two of these machines
IN OPERATION *at* REED-PRENTICE BOOTH 408
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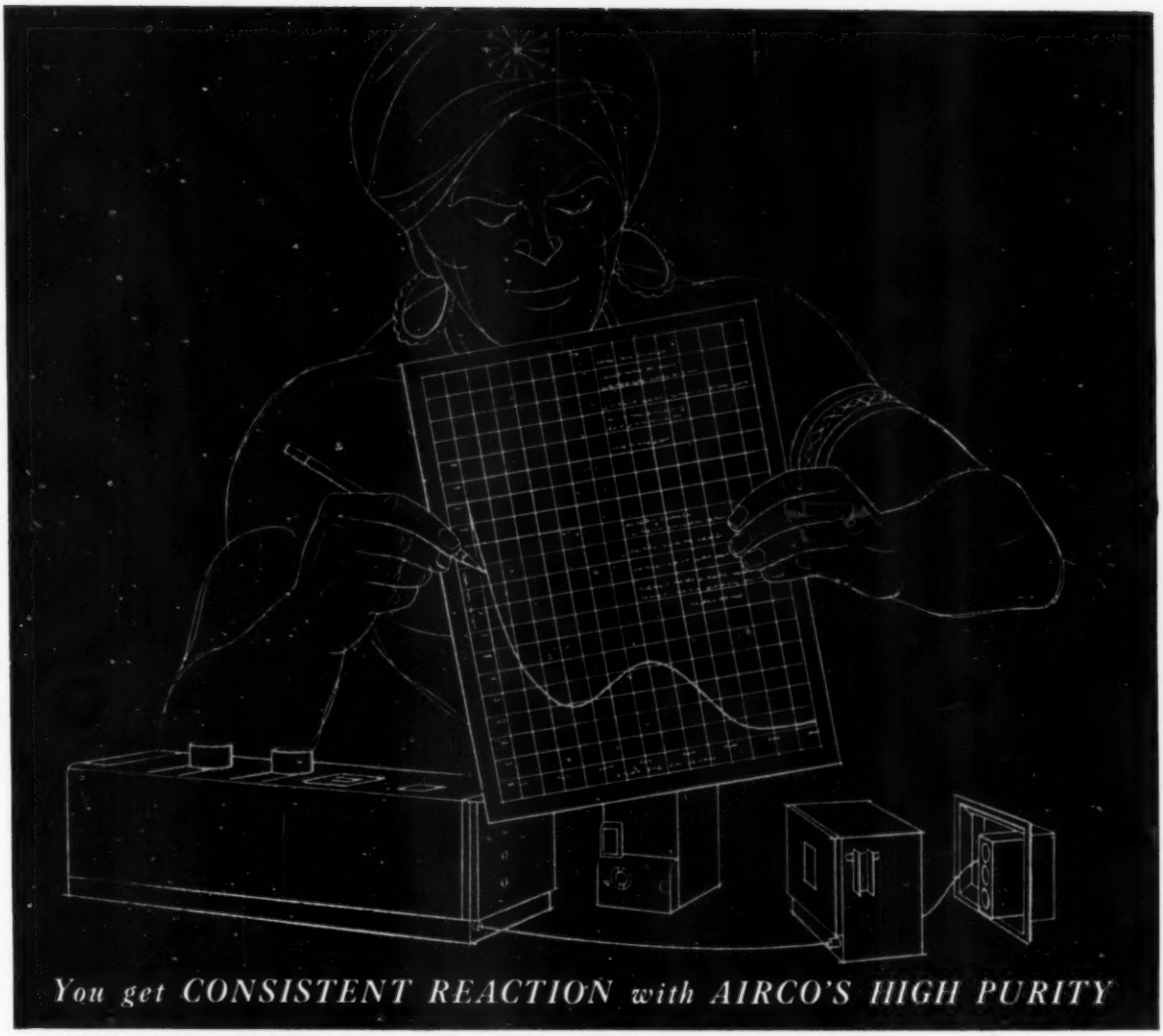

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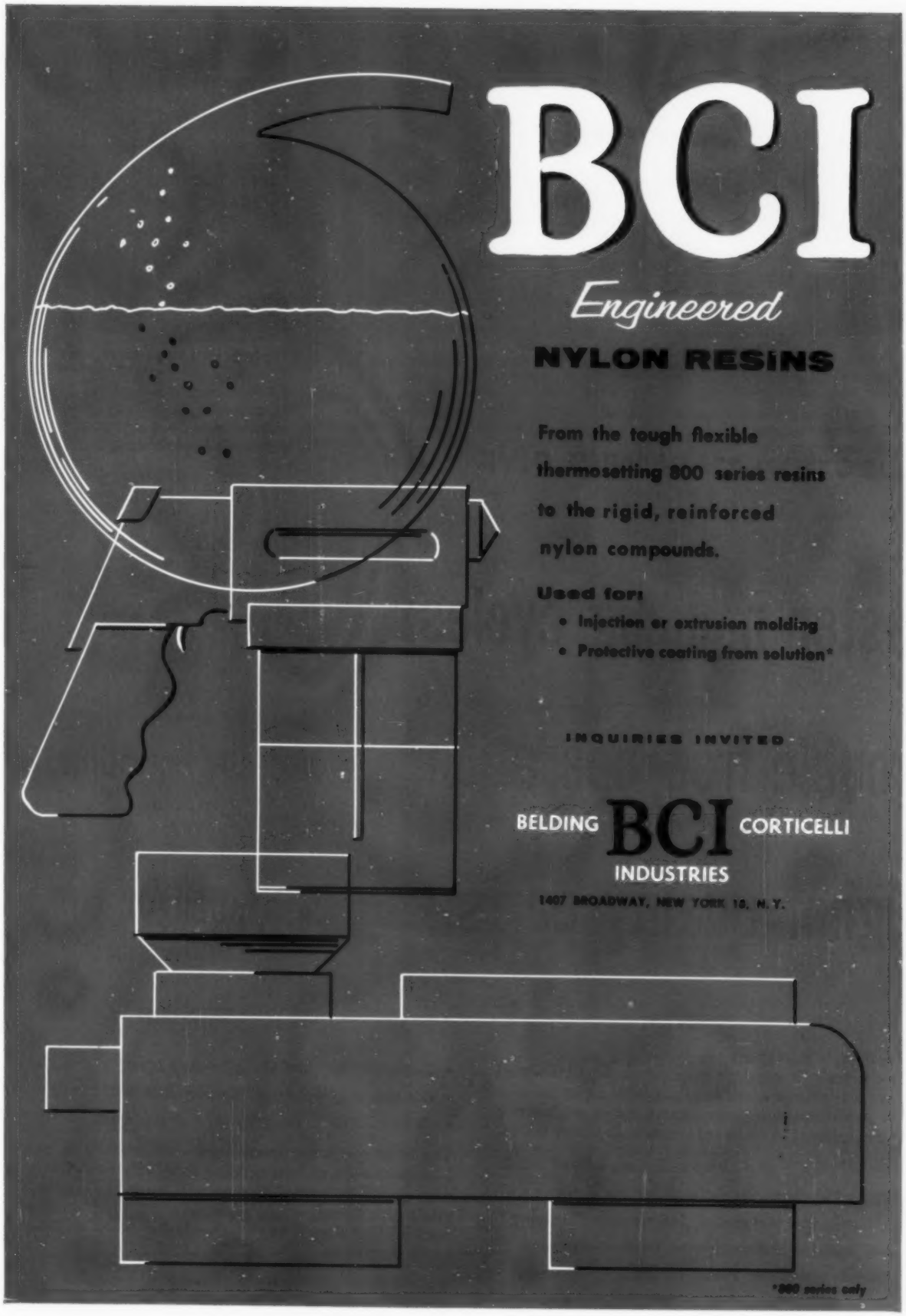
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Natco is truly "a molder's molding machine" designed to give you greater speed with complete dependability. Each production unit incorporates major engineering features, many of which have never been available before!

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.... polystyrene ..... acrylics ..... cellulosics

Seventy radio cabinets per hour . . . 21½ oz. shot. Natco's 400 kept rejects below 1%! Two speed injection, big platens, high speed injection, lots of plasticizing capacity, precision built ejector (vertical or horizontal), prepack, add up to profitable polystyrene production with Natcos.

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The complete Natco Line includes . . .

	NATCO 300	NATCO 400	NATCO 400X	NATCO 800	NATCO 800X
Shot Size, Ozs.—Single Feed	22	28	28	85	85
Melt Capacity (lbs./hr.)	130	165	165	350	350
Platens (inches)	33 x 33	38 x 38	38 x 38	55 x 55	55 x 55
Clearance Between Rods	21½ x 21½	25 x 25	25 x 25	36½ x 36½	36½ x 36½
Clamp Tonnage (max.)	325	*425	*425	850	850
Clamp Stroke (max.)	24"	26"	26"	**40"	**40"
Daylight Opening (max.)	42½"	50"	50"	85"	85"
Injection Speed (cu.in./min.)	1125	1140	2280	2000	4000

*Also available with 550 ton clamp. **Also available with 55" stroke.

PLASTICS MACHINERY DIVISION

National Automatic Tool Co., Inc.

RICHMOND, INDIANA

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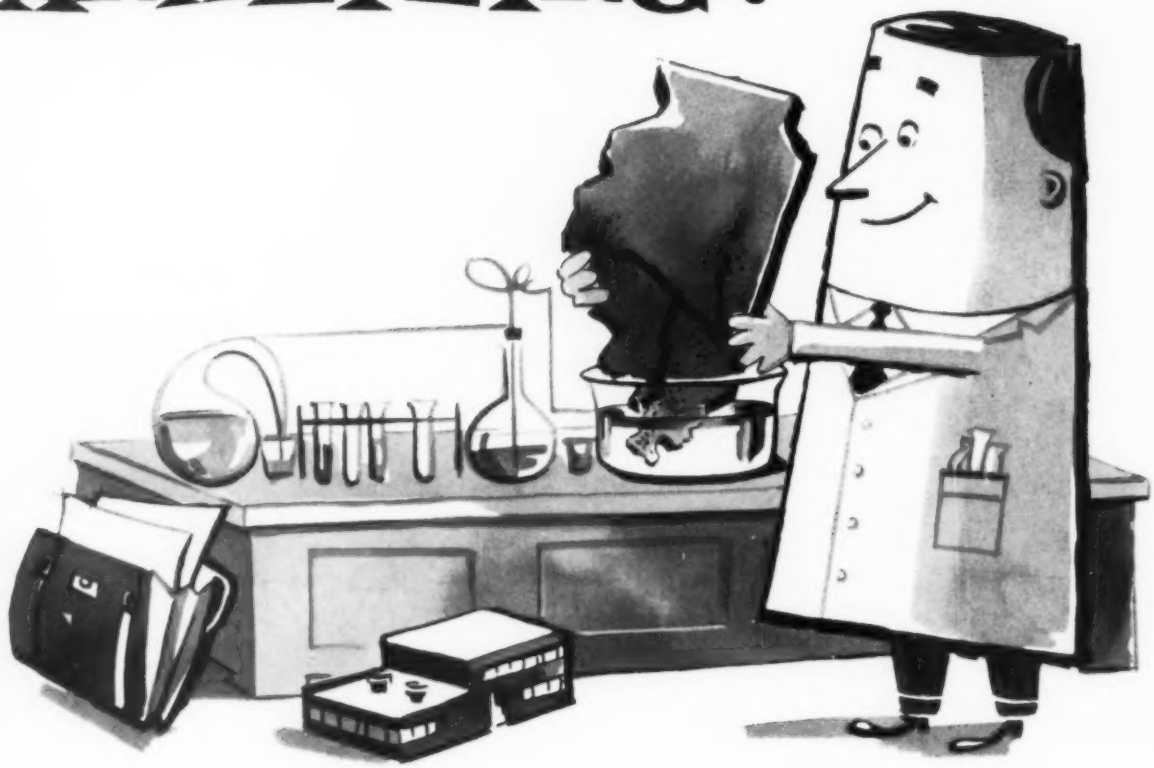

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Whatever formula you have for locating that new plant, apply it to CIPStowns. Check them for markets, manpower and raw materials. CIPStowns will meet your requirements . . . and then some! Plus factors that tip the balance are the friendly, cooperative people who will be your employees and neighbors; readily accessible sites in civic conscious communities; and minimum transportation costs because of the nearness to supply and distribution centers.

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GENERAL OFFICES: ILLINOIS BUILDING, SPRINGFIELD, ILLINOIS

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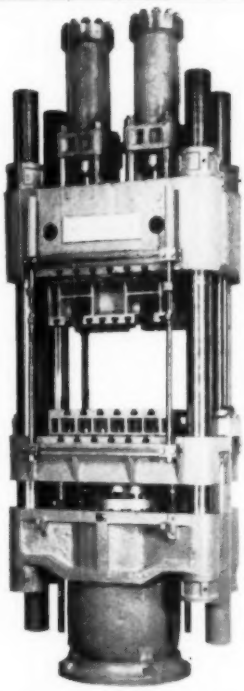
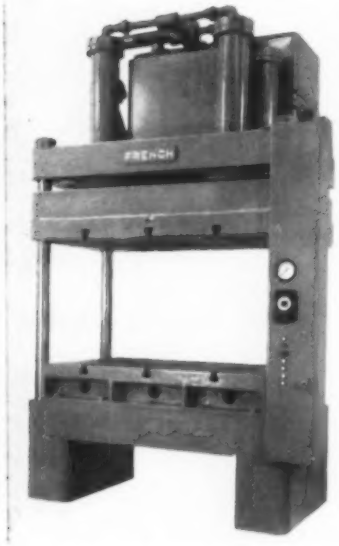
for Compression Molding Transfer Molding Laminating

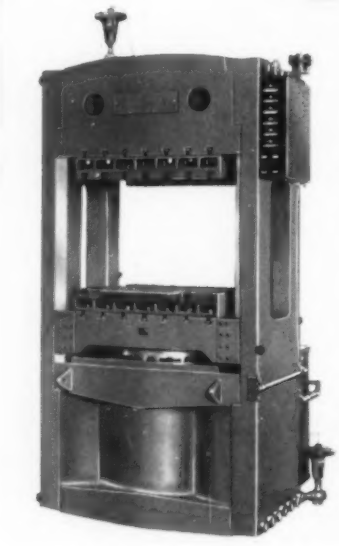
French builds a complete line of standard and custom made oil or water hydraulic presses in sizes up to 4000 tons. Available in either side plate or column type construction, self-contained or for use with accumulators, these presses are supplied with semi automatic controls. Backed by many years of hydraulic engineering and manufacturing experience, French presses are designed to meet specific job requirements. Incorporated in the basic design are many outstanding and patented features that have earned them an enviable record for high quality production efficiency and low cost, maintenance-free, operation.



519 ton Transfer Molding Press; 30" Stroke; 38 to 60 Adj. Daylight; 34" x 32½" Pressing Surface; 3000 P.S.I. Working Pressure



200 ton Fiber Glass Molding press; 36" Stroke; 54" Daylight; 72" x 48" Pressing Surface; 2000 P.S.I. Working Pressure



800 ton Compression Molding press; 24" Diameter ram; 16" Stroke; 41" Daylight; 48" x 36" Pressing Surface.

300 ton Compression Press; 19½" Diameter ram; 2000 P.S.I. Working Pressure; 24" Stroke; 28" to 52" adj. Daylight; 48" x 31" Pressing Surface

Illustrated are only a few of the many types of presses designed and built by French. For more complete information and illustrated bulletins on French Hydraulic Presses, write us today!

HYDRAULIC PRESS DIVISION

french

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THE OUTSTANDING STABILITY OF

DAPON® RESIN

TO IMPROVE PRODUCT PERFORMANCE AND LOWER COSTS IN MOLDINGS AND LAMINATES

Thermal Stability

DAPON resin molded parts exhibit outstanding stability under extreme conditions of exposure to heat and humidity. Under such conditions they do not crack or change shape. For example, after several months exposure to boiling water, DAPON resin molded cups show no degradation of any kind. DAPON resin molded parts are serviceable at temperatures up to 400-450°F. Higher temperature modifications of DAPON resins are currently under development.

Dimensional Stability

DAPON resin exhibits almost no shrinkage during cure and no shrinkage following cure. The lack of post-mold shrinkage makes possible formation of complex matching parts with close tolerances and small or large metallic inserts without cracking.

Chemical Stability

DAPON resin compounds are extremely resistant to acids, bases and organic solvents even at high temperatures, as well as to staining and color degradation.

Electrical Stability

DAPON resin molded parts are noted for the retention of their excellent insulation resistance, dielectric strength, and arc resistance even after exposure to high humidity and to elevated temperatures. DAPON resin's unusual chemical stability insures absence of breakdown and attendant corrosion of metallic electronic components under the most severe conditions of use. DAPON resin is unmatched by any other plastic in this regard.

Color Stability

DAPON resin can be compounded in pastel colors which exhibit greater color stability at elevated temperature than any other known colored plastics.

For Help In Solving Your Problems

Write today for technical literature detailing properties, uses and methods of application for DAPON resin.

*DAPON Resin is Food Machinery and Chemical Corporation's registered trade name for its brand of diallyl phthalate prepolymer. Names of compounders of DAPON resin molding powders are available on request.

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Sylvania's new catalog of vacuum metallizing coils lists 164 shapes and sizes. Most of these have become standards for efficiency in the applications for which they were designed.

Whether your interest is in finished coils or top-quality stranded wire, if you form your own coils, Sylvania can help you.

Here's how to find the one coil that's best for you

Sylvania can help analyze your coil needs if you supply us with the following information:

1. What type and weight material is being evaporated?
2. What material is being coated?
3. What is the length and diameter of your equipment?
4. What is the power supply to the coil and the distance between electrodes?

Address this information or your request for Sylvania's new catalog to:
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FOR FASTER CYCLING AND BETTER PRODUCTION

MODEL M-1 INJECTION MOLDING MACHINE

12 CYCLES PER MINUTE
LOWER COSTS • TOP EFFICIENCY

PLASTICIZING CAPACITY	150 lbs./hr.
MAXIMUM DAYLIGHT	32"
CLAMPING PRESSURE	400 tons
MAXIMUM MOLD SIZE	20" x 30" horiz. 16" x 32" vert.

THE NEW DE MATTIA MODEL M-1 offers a new opportunity to increase and improve your production, raise your molding profits.

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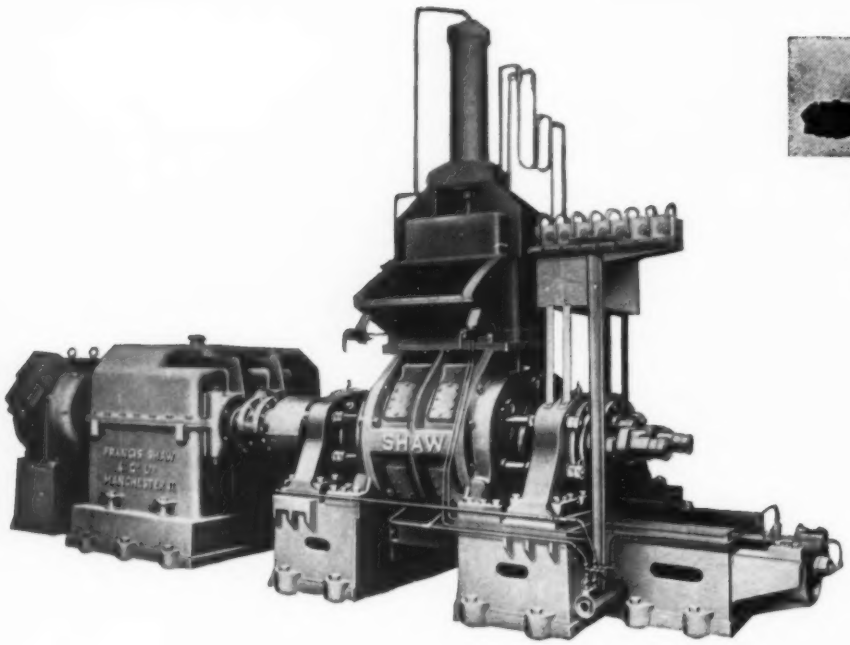

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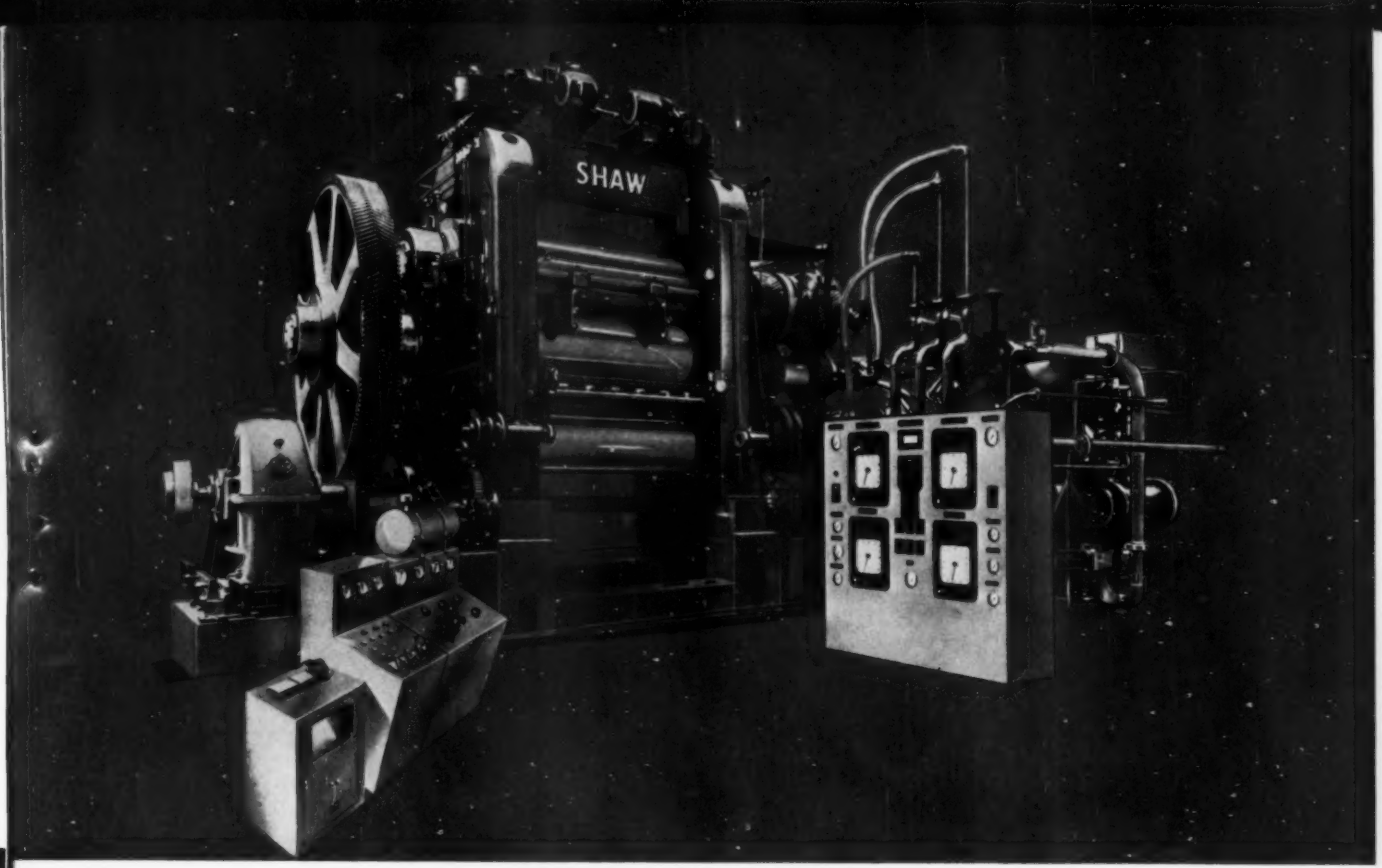
Francis Shaw are available for the design, manufacture, and installation of a wide range of processing equipment



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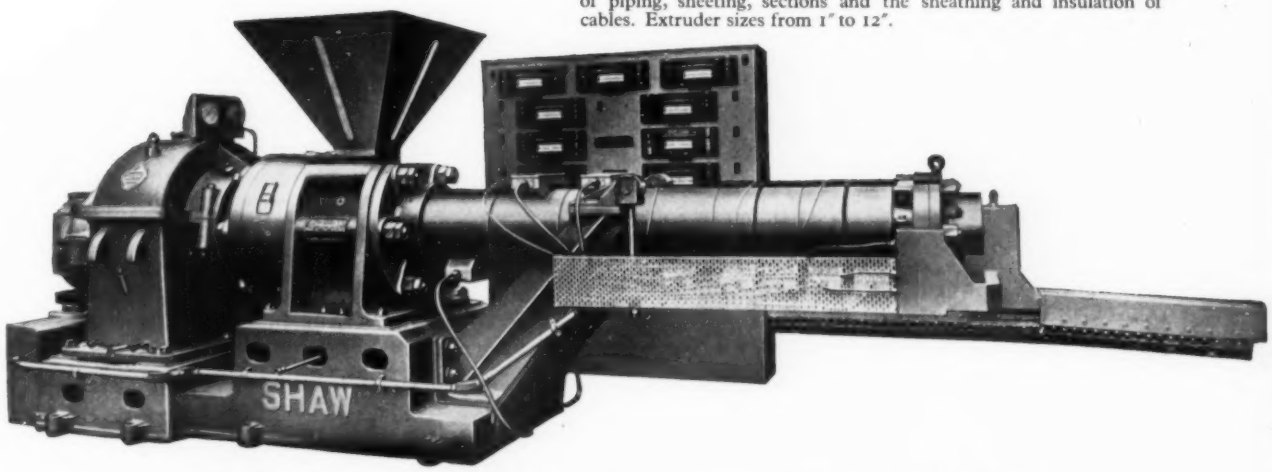

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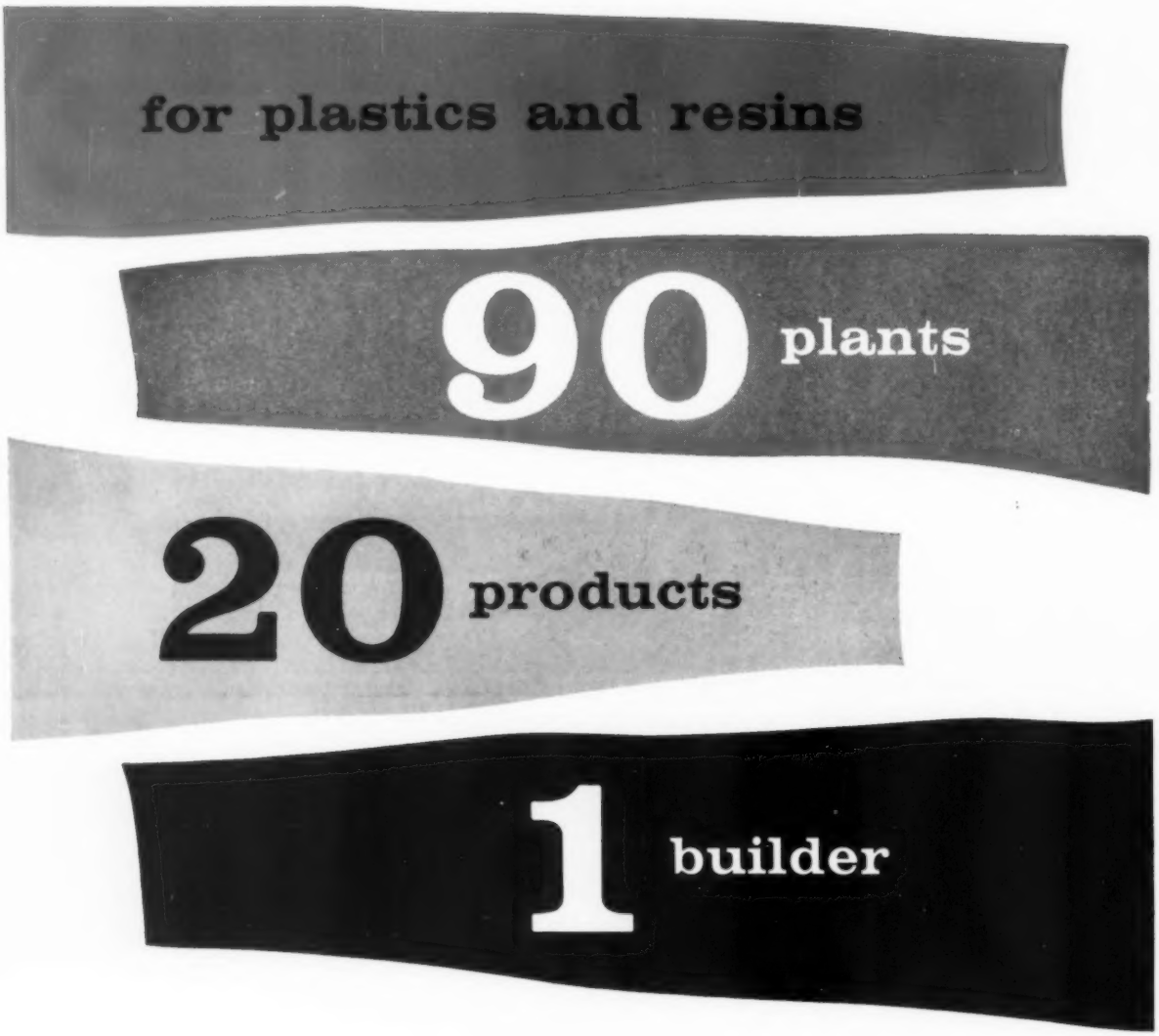

Blaw-Knox, pioneer in the industry, sets the pace in designing and building plants for polymer and resinous compound production.

Blaw-Knox has led for twenty-five years in plant development for products ranging from condensation polymers such as alkyds and polyesters to addition polymers including synthetic rubber, polyvinyl chloride and polyvinyl acetate. Blaw-Knox construction parallels the mushrooming growth of the industry.

Blaw-Knox unexcelled know-how will pay off on your next project. A complete service is available—from preliminary planning to initial operation. For details contact Blaw-Knox Company, Chemical Plants Division with headquarters in Pittsburgh. Branch offices in New York, Chicago, Haddon Heights, N. J., Birmingham, Washington, D. C., San Francisco.

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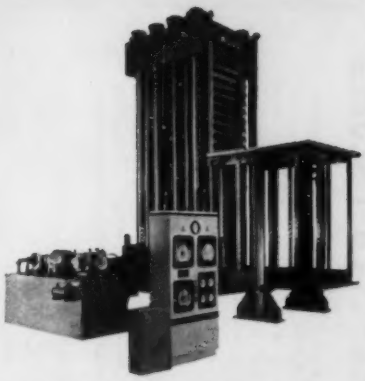

2,000-ton R. D. Wood Hydraulic Press for laminating and polishing plastics. Press has 10—4" openings, platen size 42"x83", and is of the completely self-contained type, including pumping unit for semi-automatic control of time, pressure and temperature. Press is equipped with hydraulic loading and unloading elevator. Send for complete details of this or other R. D. Wood Presses for the plastics industry, without obligation.

The most productive plants use R. D. Wood Presses

For proof, look at production records—and downtime for maintenance. Then watch an R. D. Wood Press at work. See for yourself the smooth, precise operation—the dependable performance—even under tough conditions. Finally, inspect an R. D. Wood Press up close. Notice the soundness of design, the excellence of materials, the scrupulous care given to each detail of construction. These are the reasons why R. D. Wood Presses are the standard of excellence throughout the plastics industry.

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Dozens of American installations testify to the fast-growing demand for BIPEL equipment. Compression-Transfer Presses, like these, offer the utmost in fast production, economy and dependability. Individual or multiple units with central drive systems . . . fully or semi-automatic, or manual control . . . a wide selection of speeds, capacities and pressures . . . add up to a remarkable degree of flexibility for these manufacturers.

New **fully-automatic** models require no more floor space than a standard press with operator. Each offers a choice of pressures up to 90 or 225 tons . . . and mold changes are as fast as in operator-controlled molding.

The selection of BIPEL fast-acting Compression-Transfer Presses has been widened to include 8 variable pressure ranges from 24 to 660 tons maximum pressure . Thus there is a BIPEL press to meet most requirements. Please contact us for specific recommendations.

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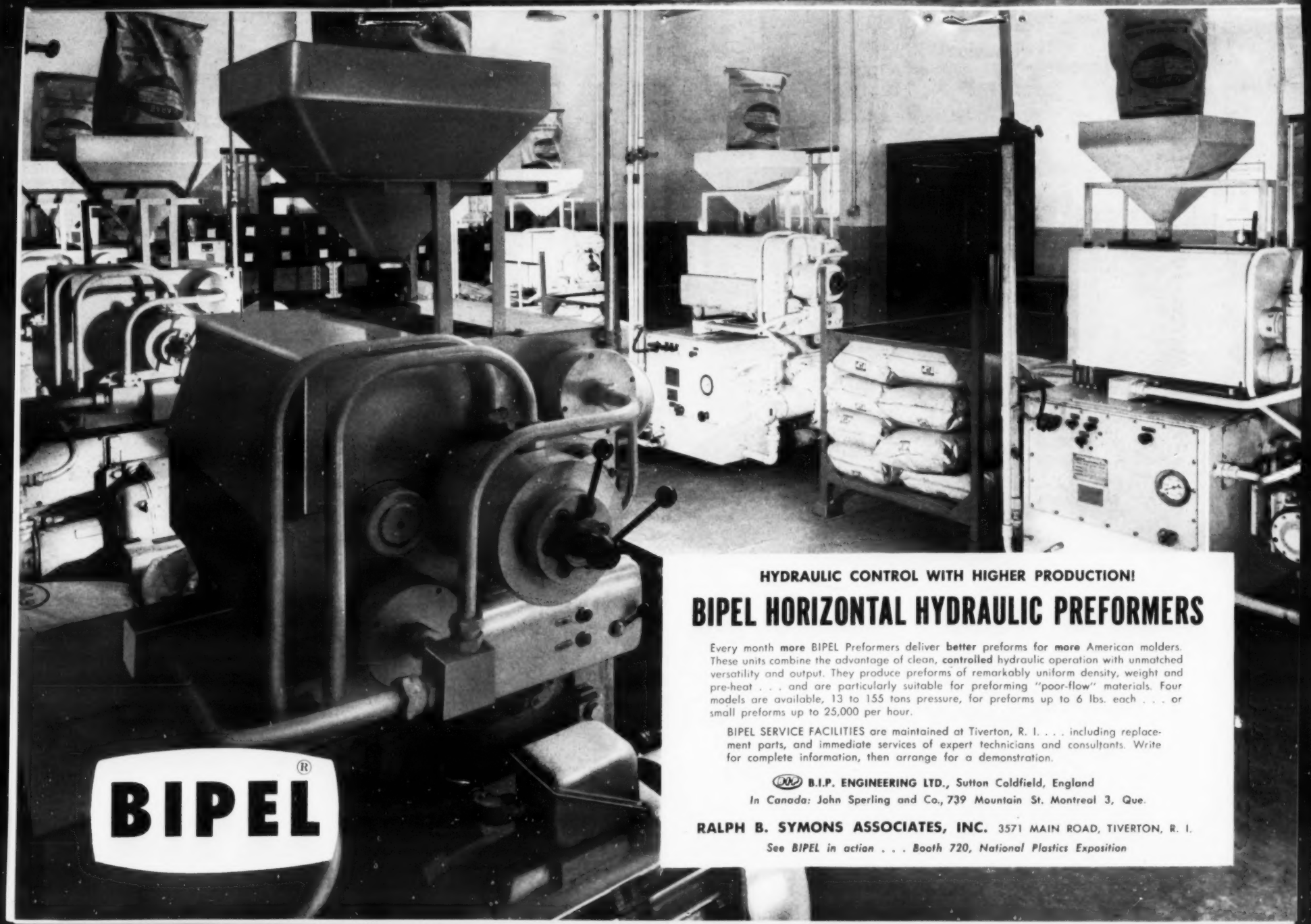

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BIPEL HORIZONTAL HYDRAULIC PREFORMERS

Every month **more** BIPEL Preformers deliver **better** preforms for **more** American molders. These units combine the advantage of clean, **controlled** hydraulic operation with unmatched versatility and output. They produce preforms of remarkably uniform density, weight and pre-heat . . . and are particularly suitable for preforming "poor-flow" materials. Four models are available, 13 to 155 tons pressure, for preforms up to 6 lbs. each . . . or small preforms up to 25,000 per hour.

BIPEL SERVICE FACILITIES are maintained at Tiverton, R. I. . . . including replacement parts, and immediate services of expert technicians and consultants. Write for complete information, then arrange for a demonstration.

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DYLENE polystyrene and SUPER DYLAN polyethylene used in new-type screw-feed container

This screw-feed deodorant is a brand-new approach in the deodorant market. So new, that a different method of packaging had to be developed—and two Koppers plastics were picked for the job.

Here's why:

(1) Mennen research chemists needed a relatively impermeable material that would keep the deodorant fragrance sealed in the container. Answer—DYLENE!

(2) The functional design of the interior base, its wearability and toughness demanded a chemically inert plastic of dimensional stability. Answer—SUPER DYLAN!

Thus, not one, but two Koppers plastics, DYLENE and SUPER DYLAN, have been used to excellent advantage in the new Mennen "SPEED STICK" deodorant. Try one of these fine Koppers plastics in your next packaging operation: DYLITE expandable polystyrene, DYLENE polystyrene, SUPER DYLAN polyethylene and DYLAN polyethylene.

Wire or write Koppers Company, Inc., Plastics Division, Dept. M-118, Pittsburgh 19, Pa. TWX Call Number . . . PG533

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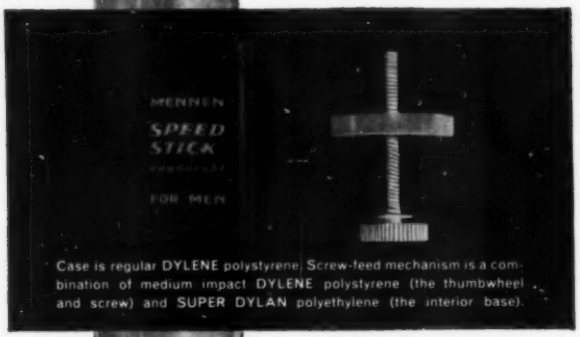

Case is regular DYLENE polystyrene. Screw-feed mechanism is a combination of medium impact DYLENE polystyrene (the thumbwheel and screw) and SUPER DYLAN polyethylene (the interior base).

MOLDER: Owens-Illinois Glass Co., Toledo, Ohio

Packaging Institute's
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with STAN-TONE colors for plastics or rubbers

Almost is not good enough. Working with hundreds of standard Stan-Tone pigments, Harwick laboratory men mix test batch after test batch until they arrive at an ***exact match*** . . . in hue, intensity and value.

This conscientious color control is followed through from formula mix to shipping container. Shipment after shipment, you receive color which is carefully matched to your original sample . . . and has uniform working qualities.

Pigments are selected for their brilliant masstones and for compatibility. Heat and light stability and high resistance to migration, crocking, bleed and other compounding problems are built right into the color materials. The Harwick man has full data on behavior of specific pigments in organasols, plastisols, PVC, polyethylene and rubber.

Stan-Tone colors are available dry, dispersed in plasticizer, in polyester resin or in polyethylene, and in masterbatch in rubber elastomer.

- **STAN-TONE** *Dry Colors Organic and Inorganic*
- **STAN-TONE** *PEC Polyester (Paste)*
- **STAN-TONE** *PC Paste (In Plasticizer)*
- **STAN-TONE** *MBS Masterbatch*
- **STAN-TONE** *GPE (Polyethylene)*

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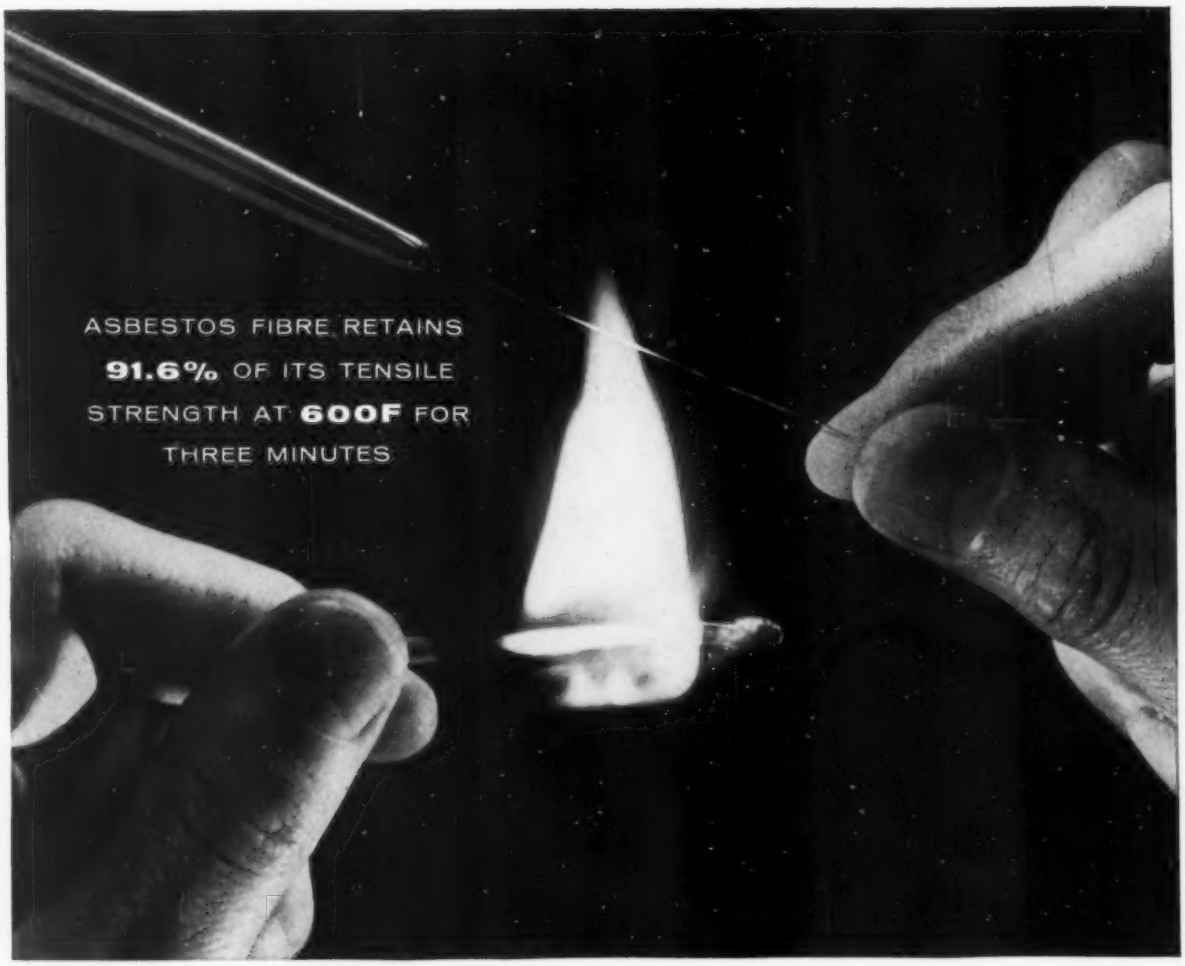

The **heat resistance** of J-M Asbestos Fibre can put your plastics in the high-temperature zone

Now . . . by reinforcing with the "magic mineral" to gain amazing heat-resistance . . . suppliers of plastic components can open up new avenues of profit in a wide variety of industries.

Here are just a few proposed and new product developments utilizing asbestos-reinforced plastics:

- automobile exhaust pipes and distributor heads with exceptional thermal stability
- guiding vanes for rocket motors where temperatures exceed 4500F
- furnace intake baffles that withstand intense heat
- electrical appliance plugs that exceed Underwriter's requirements.

The superiority of asbestos as a reinforcer is supported by a study reported in June MODERN PLASTICS titled "Now—into the space age!" This study disclosed that asbestos fibre reinforced resins seem to hold up best even at temperatures far above normal. For example—even on exposure to hot gases moving at high speed . . . such as in a rocket's blast tube.

In addition to this remarkable property, you will find that Johns-Manville Asbestos Fibre, because it is of the Chrysotile variety, provides the best combination of properties offered by any filler on the market. It bulks, reinforces, controls impact strength, improves dimensional stability. And it even reduces molding costs whether you work with thermoplastic, thermosetting, or cold-molded plastics.

If you would like more information on how you can improve plastics with this J-M "magic mineral," write for your free copy of brochure AFD-8A. Address: Johns-Manville, Asbestos Fibre Division, Box 1500, Asbestos, Quebec, Canada.

Characteristics of J-M Chrysotile Asbestos used in the Plastics Industry:

Type of Asbestos: Chrysotile

Specific Gravity: 2.4—2.6

Color: Dry: Light gray—Wet: Dark gray

Approximate Chemical Analysis:

MgO	.40-42	FeO	.Tr-6
SiO_2	.38-42	Fe_2O_3	.Tr-6
H_2O	.12-15	Al_2O_3	.Tr-3

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In our ten years of serving the plastics industry with pre-matched color compounds for polyethylene and other thermoplastic materials, we have always kept pace with the industry's most dramatic new developments. No wonder we are now among the first to offer a pre-matched color concentrate which has been custom-tailored for the new linear polyethylenes . . . designed to eliminate degrading, migrating and leaching, while it gives better temperature and chemical resistance.

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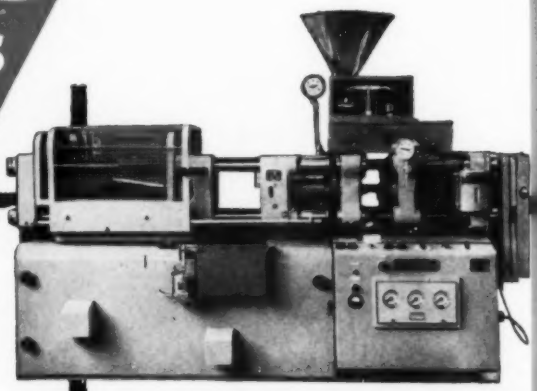
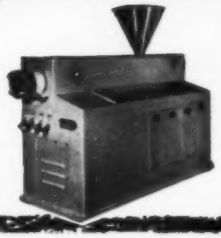


Automatic Injection Molding Machines, 1/10 to 150 ozs.



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These National Aniline Curing Agents have six important advantages for epoxy resin users:

Ease of Handling – Two are liquids, the third a low melting (35°C) solid. Thus, they can easily be mixed with liquid epoxy resins at or slightly above room temperature. Or solid epoxies, heated slightly above the melting point, can be blended with the anhydrides.

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Greater Latitude in Formulations – both for desired heat distortion temperature (HDT) and finished castings hardness.

Longer Pot Life of Catalyzed Resins.

Lower Volatility at curing temperatures and lower peak exotherms.

Excellent Thermal Stability of cured resin.

Technical Data Sheets giving properties on each anhydride are available. Working samples and prices will be furnished on request.

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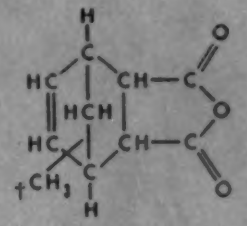
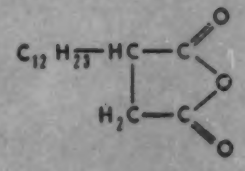
* as described in U.S. Patent #2,324,483

METHYL NADIC® ANHYDRIDE

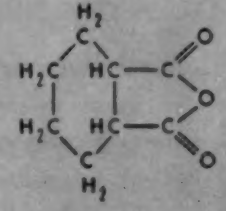


† the methyl group replaces one of the hydrogens

DODECENYL SUCCINIC ANHYDRIDE



HEXAHYDROPHTHALIC ANHYDRIDE



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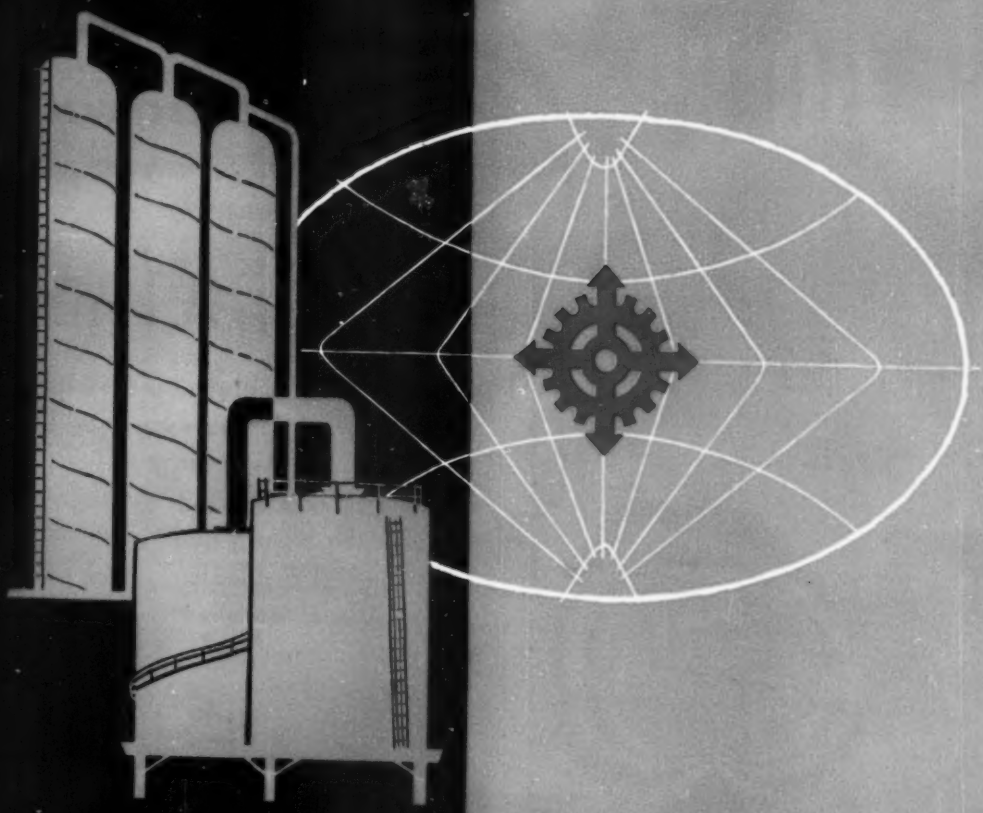
MATERIALS, MACHINERY, METHODS FOR THE PLASTICS INDUSTRY



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THIS IS CYCOLAC... AND WHAT IT CAN DO FOR YOU!

This family of single uniform resins is extremely tough and versatile; extrudes readily, in profiles and sheets; easily injection molded and post formed.

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- Readily injection molded in fast cycles

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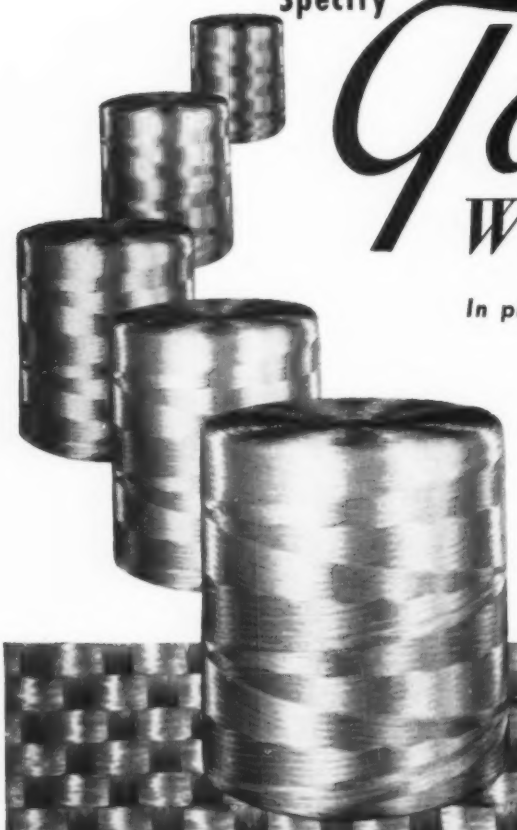
Specify

Garan® WOVEN ROVING



In production, Garan Woven Roving:

- **BONDS BETTER WITH RESINS**
- **WETS OUT 3 TO 5 TIMES FASTER**
- **CUTS LAY-UP TIME SUBSTANTIALLY**
- **PERMITS MORE UNIFORM LAMINATES**
- **CONFORMS WELL TO THE MOLD**

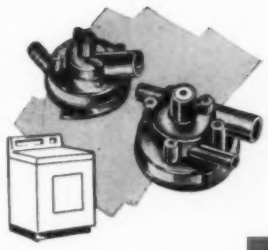
RESULT:
Stronger Reinforced Plastic Products at Less Cost; Increased Sales Acceptance

L·O·F Glass Fibers Co., pioneers in the development of the Garan binder, supplies these high-strength glass fibers to weavers who produce fabric in standard weights and sizes.

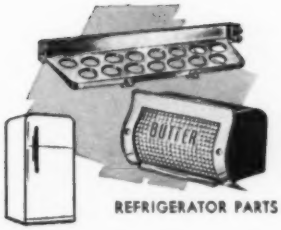
L·O·F GLASS FIBERS

L·O·F GLASS FIBERS COMPANY

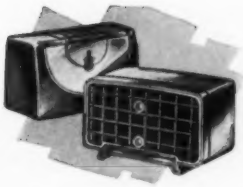
For the Garan Roving Story: *write, Dept.* 15-118, *1810 Madison Ave., Toledo 1, Ohio*



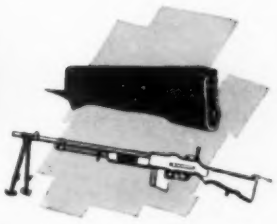
WASHER AND DRYER PARTS



REFRIGERATOR PARTS

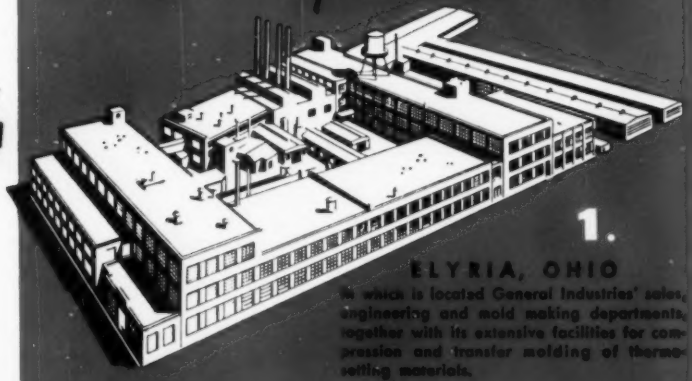


RADIO CABINETS



GOVERNMENT WORK

NOW...TWO modern plants to produce your custom molded plastics *Efficiently... Economically... On Time!*

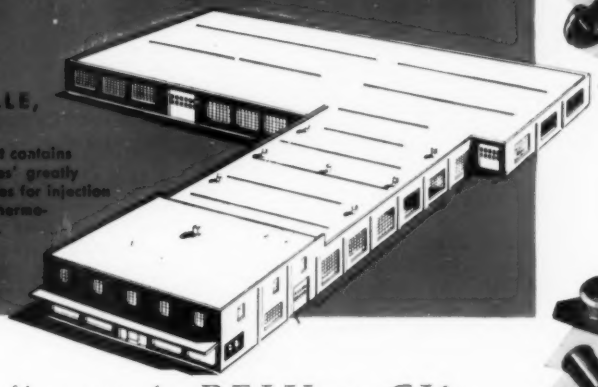


1. ELYRIA, OHIO

In which is located General Industries' sales, engineering and mold making departments, together with its extensive facilities for compression and transfer molding of thermosetting materials.

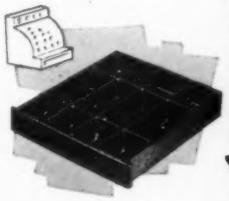
2. MARYSVILLE, OHIO

This modern plant contains General Industries' greatly expanded facilities for injection molding of all thermoplastic materials.



APPLIANCE HANDLES

VACUUM CLEANER NOZZLES



CASH REGISTER DRAWERS

CASTERS

TEXTILE MACHINERY PARTS

TELEPHONE SETS

INDUSTRIAL GEARS

ELECTRICAL PARTS

...it pays to RELY on GI!

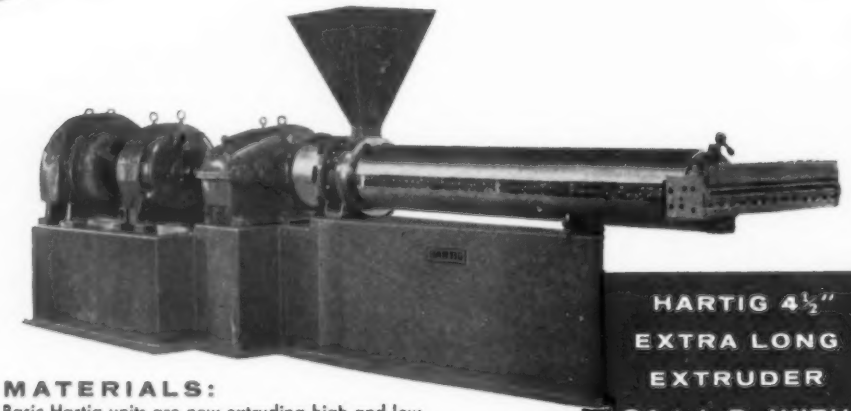
- **COMPLETE ENGINEERING SERVICE**
- **COMPRESSION MOLDING** 150 presses ranging up to 1850 ton capacity.
- **INJECTION MOLDING** 17 presses ranging up to 200 oz. capacity.
- **FINISHING EQUIPMENT** Automatic facilities include equipment for trimming, polishing, buffing, drilling, tapping, tumbling and painting.
- **MOLD MAKING FACILITIES** General Industries' own tool and die shop is capable of producing all types of high quality custom molds and dies.

THE GENERAL INDUSTRIES CO.

PLASTIC DIVISION • ELYRIA, OHIO

PACKAGED

HARTIG EXTRUSION



HARTIG 4½" EXTRA LONG EXTRUDER 24:1 L/D, WITH SHEETING DIE

MATERIALS:
Basic Hartig units are now extruding high and low density materials most used in packaging—Polyethylene, Polypropylene, Vinyls, Styrenes, and many others.

PROCESSES:
Film Extrusion—Blown Tubing, Unsupported Film, Extrusion-Coating, Extrusion-Laminating
Sheet Extrusion—Vacuum Forming
Blown Containers—Molding
Compounding—Reprocessing.

FEATURES:
Unexceeded capacity—available in four L/D ratios; unvented or vented for continuous removal of moisture, solvents and monomers; with constant pitch, decreasing depth or variable pitch screws, self venting, recirculating, and many alternate constructions to match the specific requirements. Instrumented for close control of quality and automatic operation.

AUXILIARY EQUIPMENT:
Auxiliary equipment includes film or laminating dies, dies for blown tubing and lay flat tubing and special purpose dies. Also payoffs, takeoffs, and troughs; cooling and polishing rolls; laminators with unwind and rewind stations; pelletizers and other special purpose equipment. Matched with Waldron and Ross equipment for complete packaged units.

Send for Your Copy

of the new booklet describing the complete line of Hartig Extruders and Auxiliary Equipment.

Established 1890

HARTIG EXTRUDERS

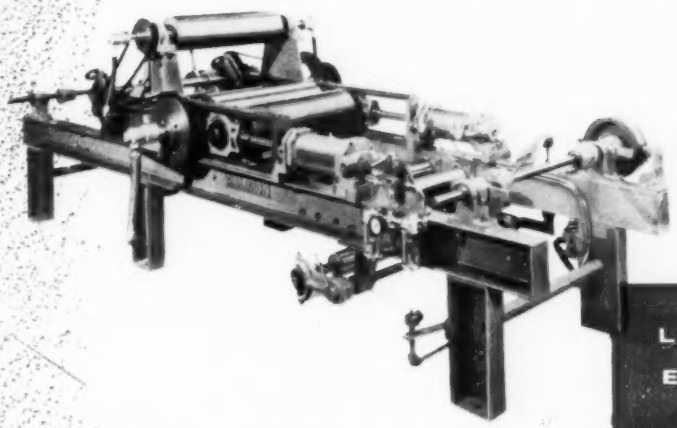
Division of Midland-Ross Corporation
Mountainside, New Jersey

Booths 747 and 749 at the Eighth National Plastics Exposition

D UNITS

WALDRON

LAMINATION



LAMINATORS
•
EMBOSSERS
•
PRINTERS
•
COATERS

WALDRON LAMINATORS

In the field of extrusion-lamination, Waldron Engineers have developed to a high degree of success the equipment required to take advantage of the physical properties of thermoplastic resins to produce a laminate of pre-formed metered film which is applied to a supporting web while still sufficiently fluid to obtain good adhesion.

In the design and construction of complete processing lines, Waldron works closely with the Hartig and Midland-Ross Divisions of Midland-Ross Corporation. This offers an unequaled combination of engineering skills and experience.

Send for Our New Catalog

No. 10

with its 130 pages of descriptions, photographs and drawings indicative of the broad line of Waldron Web-Processing Equipment.

John **WALDRON** *Corp.*

Subsidiary of Midland-Ross Corporation

NEW BRUNSWICK, NEW JERSEY

Booths 747 and 749 at the Eighth National Plastics Exposition

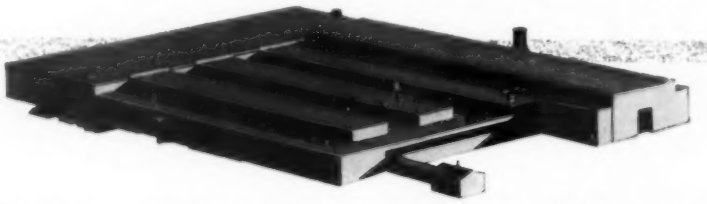
"Start to Finish" Service

...It can mean a great deal to You!

Product design • Material choice
Engineering of molds and assembly equipment
• Color selection • Molding • Quality control
• Testing and inspection • Decorative
painting and printing • Special packing and drop shipping

. . . all are a part of "Start to Finish" service.

Let us help you work out your problems from "Start to Finish"
with the fully co-ordinated facilities of our modern factory.



MINNESOTA PLASTICS CORPORATION

45 E. MARYLAND AVENUE • SAINT PAUL 3, MINNESOTA

Rubber crumbles... cost tumbles

Processing costs go down when you use Ameripol 1006 rubber in "crumb" form. This unique form eliminates milling, cutting and pelletizing. Ameripol 1006 crumb rubber can be easily dissolved in a churn or simple agitated vessel.

This new development in synthetic rubber, an exclusive Goodrich-Gulf product, saves you time—eliminates the cutting of conventional bales of rubber.

Rubber in crumb form is an example of Goodrich-Gulf product development, designed to cut costs and simplify raw rubber handling, another reason Ameripol has become *the preferred rubber.*

Ameripol
THE PREFERRED RUBBER

More information ...samples available

GOODRICH-GULF CHEMICALS, INC.
Dept. PM
3121 Euclid Avenue • Cleveland 15, Ohio

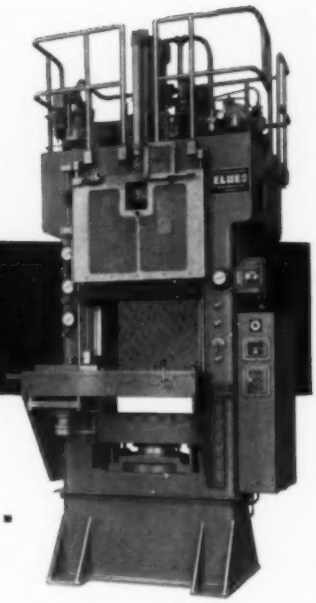
Please send information and samples of Ameripol 1006 in crumb form.

Name _____
Title _____
Company _____
Address _____
City _____ **Zone** ___ **State** _____

Goodrich-Gulf Chemicals, Inc.

Elmes.....

will "Job-Fit" hydraulic press equipment

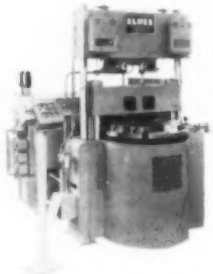


SPECIAL-DESIGN 200-TON COMPRESSION AND TRANSFER MOLDING PRESS — Combines high versatility, operating ease, and safety. Molding area protected by fixed rear door and sliding front door with interlock. Pushbutton selection for type of operation, easy regulation of press speed and pressures. Run-out table with stripper cylinder provides easy placing of inserts outside molding area.

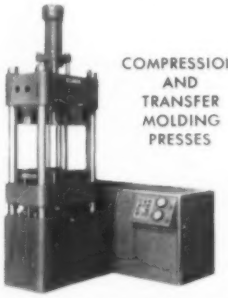
to meet *your* requirements... exactly

Whether you're seeking improved and more economical press performance for your present plastics or rubber molding production, or there's a development planning job to be done, you can count on Elmes to provide *the right press for the job.* Elmes builds a complete line of standard hydraulic presses for compression and transfer molding of thermosetting plastic materials, hot-plate laminating, molding of reinforced plastics, and laboratory work.

HYDROLAIR® PRESSES—Fast, low-cost hydraulic production presses powered by shop air line. Ideal for small-press users—for plastics and rubber molding, laminating, etc., and laboratory test work. 30, 50, 75, and 100-ton models.



RUBBER MOLDING PRESS — Special-design dual cylinder transfer press, with three-position rotating table. Two molds each for loading, transfer, and cure. Cure cycle adjustable. Press cycle automatic.



COMPRESSION AND TRANSFER MOLDING PRESSES

Standard design presses in capacities from 50 to 1000 tons. Integral power, pushbutton panel, air-operated reset of lower knockout. Adaptable to virtually any molding job. Special designs as needed.

One of these standard Elmes® designs, "as is" or with simple modifications, may fit your needs exactly. Or, your requirements may be so special as to call for development of a "custom-built" press—a type of press designing and building which has long been an important part of Elmes service to industry.

Whatever your "pressing problem", *it will pay you to call in Elmes.* It just makes sense to take advantage of engineering knowledge, skill, and foresight *backed by more than 60 years of leadership in specialized hydraulic service.*

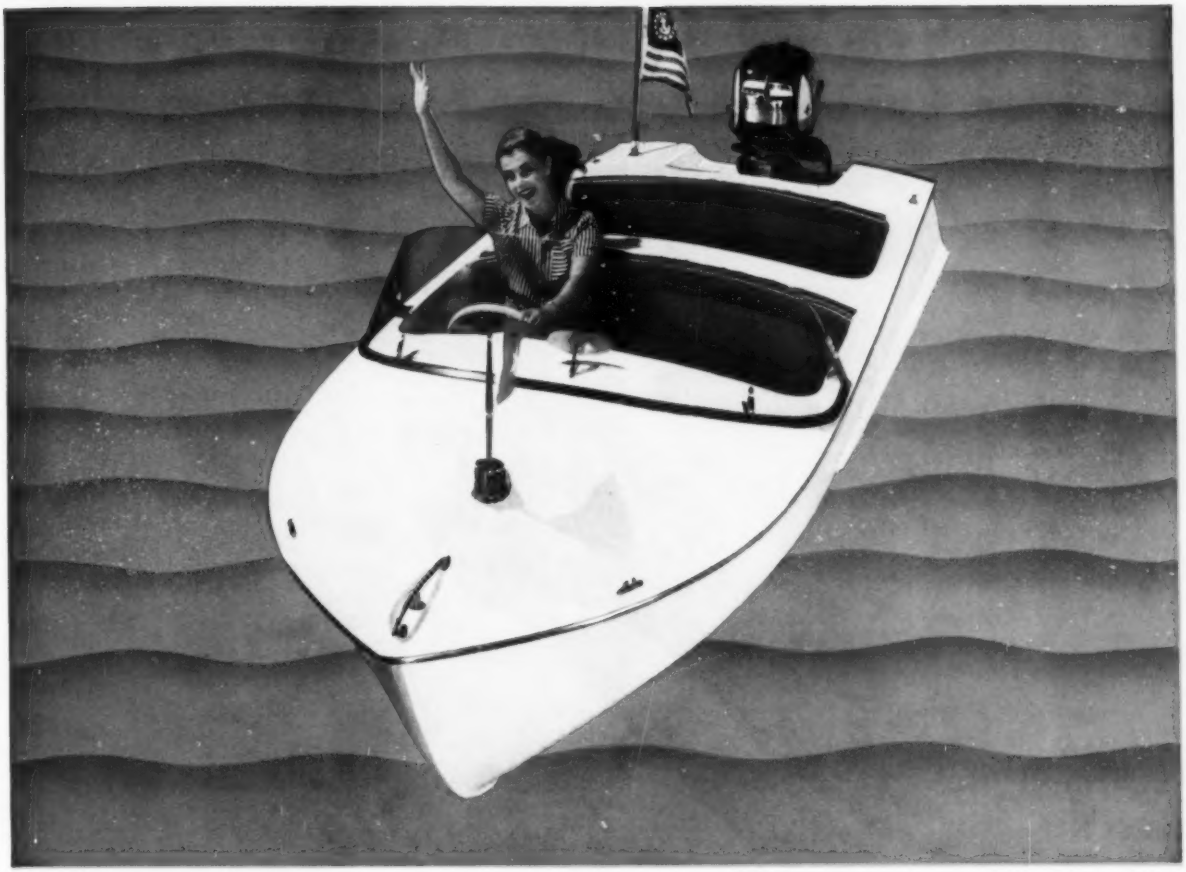
See your Elmes distributor, or write us direct. Recommendations and cost estimates will be supplied promptly.

Also a complete line of Metalworking Presses for drawing and forming, coining, forging, hobbing, bending, straightening, forcing, powder metal compacting, etc.

Elmes American Steel Foundries
ENGINEERING DIVISION

1159 Tennessee Avenue, Cincinnati 29, Ohio

METAL-WORKING PRESSES • PLASTICS MOLDING PRESSES • PUMPS • ACCUMULATORS



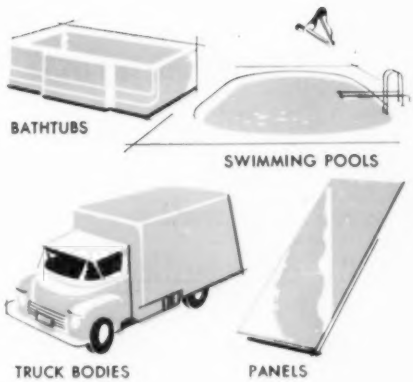
For hand layup molding of boats and other plastic products . . .

New GLIDPOL 1022 polyester resin system cures faster, speeds up production!

You can increase production rates per mold with new GLIDPOL 1022. This rigid, medium viscosity resin system contains a built-in accelerator that develops cure rapidly after gelation. Reinforced plastic parts cure to handling hardness in less than an hour at room temperature, quickly freeing molds for subsequent parts.

The GLIDPOL 1022 system is ideally suited to the manufacture of boats, bathtubs, sinks, swimming pools, truck bodies, panels, tanks, caskets and other products by the hand layup technique. And because GLIDPOL 1022 is specially treated during processing, the typical residual odor associated with room temperature cured parts is greatly reduced. To facilitate application to vertical surfaces, GLIDPOL 1022TX, a slightly thixotropic modification of GLIDPOL 1022, is also available.

Write for complete data on the GLIDPOL 1022 system, GLIDPOL resins for other fabricating techniques, and colorful, fade-proof GEL-KOTE coatings—pigmented resins that suppress fiber pattern with a smooth, durable surface that is an integral part of the finished molding.



QUALITY Glidden PRODUCTS

GLIDPOL POLYESTER RESINS

The Glidden Company • Industrial Paint Division

900 Union Commerce Bldg., Cleveland 14, Ohio

San Francisco • Los Angeles • Chicago (Nubian Division—1855 North Leclaire Avenue) • Minneapolis • St. Louis • New Orleans
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make sure in time
of fortune and success!

machines constructed by us

Injection moulding machines
semi automatic
fully automatic

Extrusion machines
complete with
all accessories

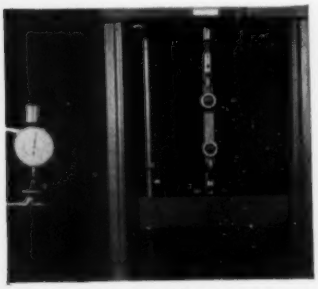
ask for our catalogues and technical publications

NB&C

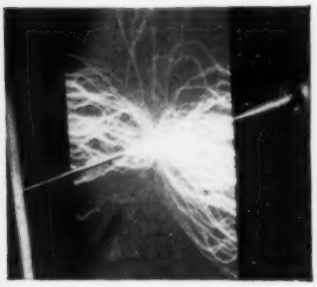
Negri Bossi & Co. S.p.A.
24, Via Bazzini MILAN (Italy)
Phone: 292.897 - 230.512
Cable: NEGRIBOS - Milan

PROPERTIES OF "MYLAR"

"Mylar" offers a unique combination of properties that may help you improve performance and lower costs of *your* product. Here are two of the many important properties for evaluation.



HIGH TENSILE STRENGTH. "Mylar" is strong and durable. Instron Tester shows an average strength of 20,000 psi. It's dimensionally stable . . . resists moisture.



HIGH DIELECTRIC STRENGTH. Average of 4,000 volts per mil . . . average power factor of 0.003 to 60 cycles .

Rome Cable reports . . .

Du Pont Mylar® helps eliminate reject problem in manufacture of cable for "Titan" ICBM

PROBLEM: In designing its instrumentation cable for the "Titan" ICBM project, Rome Cable Corporation wanted a thin, abrasion-resistant tape to protect the insulated conductors from possible puncture by loose strands of the tin-copper braid (See C in illustration). They were also searching for a thin, heat-resistant core binder tape to prevent possible puncture from the outer braid (See A) during extrusion of the cable jacket.

SOLUTION: A tape of Du Pont "Mylar" polyester film for both applications (See B&D). Reason: "Mylar" has the desired balance of mechanical and electrical properties . . . it's tough, abrasion- and puncture-resistant, even in thin gauges. "Mylar" has a high melting point . . . runs well on existing machinery.

RESULTS: The two tapes of "Mylar" eliminated shorted cables due to puncture from loose strands of metal. Solving this problem has helped Rome Cable stabilize production, save money on time and materials and produce a cable that assures better performance and greater reliability in the ICBM.

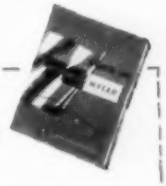
How can "Mylar" help you? Whether you manufacture heavy-duty cable or tiny capacitors, it will pay you to evaluate the combination of properties found only in "Mylar". And when figured on an area basis, this tough, thin polyester film will often *cost less* than your present insulating material. For more detailed information, send in coupon.

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

DU PONT **MYLAR**® POLYESTER FILM

"MYLAR" is Du Pont's registered trademark for its brand of polyester film.

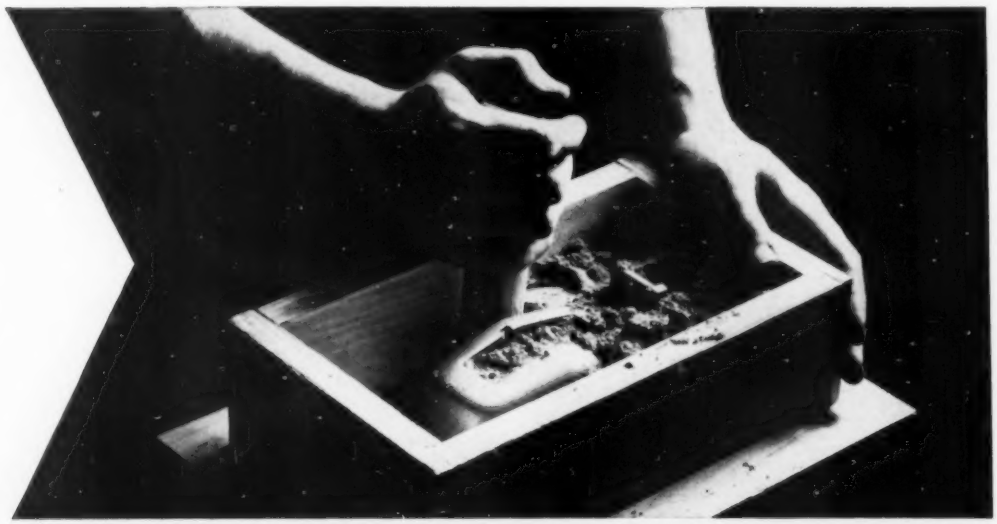


E. I. du Pont de Nemours & Co. (Inc.)
Film Dept., Room M-11 Nemours Bldg., Wilmington 98, Del.
Please send the new booklet listing properties, applications and types of "Mylar" polyester film available (MB-11).

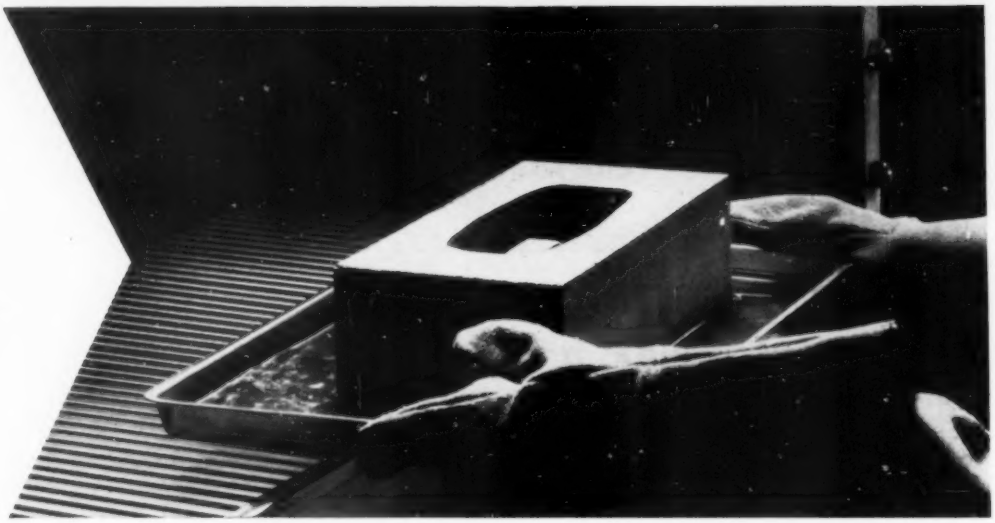
Application_____
Name_____ Title_____
Company_____
Address_____
City_____ State_____

3M Chemicals opening new worlds of use for plastics

New compound cuts tool making to two simple steps



1
PREPARE PREFORM



2
IMPREGNATE WITH RESIN

Now a tooling compound that eliminates waste, weighing, mixing, pot-life and toxicity problems. It's new 3M Brand Tooling Compound 112.

Here's all you do to make tools with Tooling Compound 112:

- mold and dry a preform of aluminum-based powder.
- place the preform in resin which impregnates the preform as it oven cures.

The result—dense, durable dies that can open entirely new fields to you. They have high strength, thermal conductivity and heat stability. In injection, compression or vacuum molding, Tooling Compound 112 lengthens die life, shortens molding cycles. Dies have no size limit, are easily machineable.

Compared to conventional compounds, Tooling Compound 112 simplifies your die making, avoids material waste. You can return excess molding powder and resin to their separate cans. Compared to metal dies, Tooling Compound 112 can reduce die costs as much as 50% to 90%. Average cost savings are over 70%.

Cut your tooling costs and time! Investigate new 3M Brand Tooling Compound 112, get free literature. Write: Chemical Products Group, 3M, Dept. WQ-48, St. Paul 6, Minnesota.

Hastings Chemical Division • Chemical Products Group

MINNESOTA MINING AND MANUFACTURING COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY **CHEMICALS**

HIGH strength LOW cost

SUPER DYLAN lawn mower wheels

AVSCO, Incorporated, Excelsior Springs, Mo., now uses SUPER DYLAN high density polyethylene in the production of their lawn mower wheels.

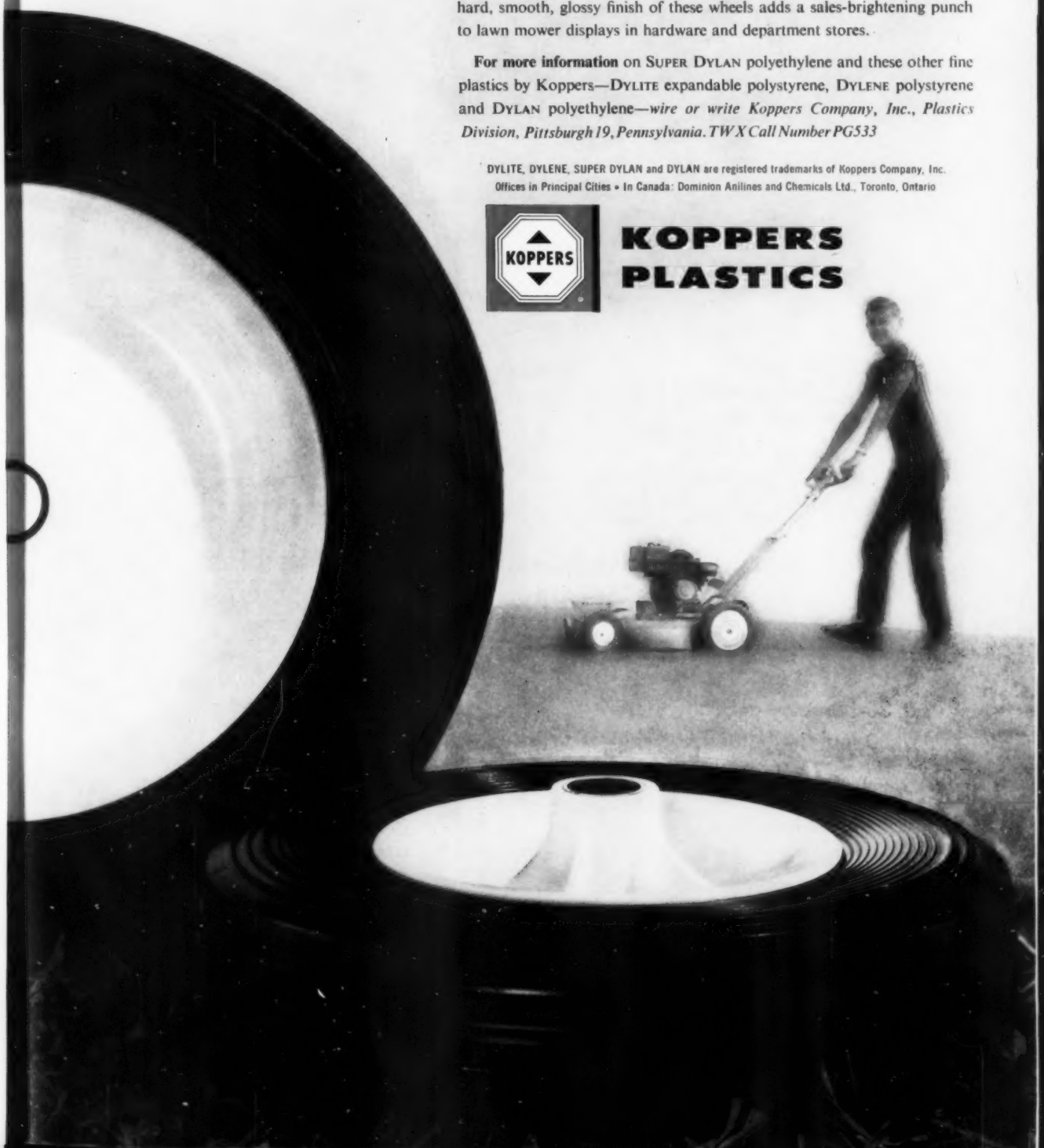
Why? Because these wheels are lightweight, rugged and rust-proof. The hard, smooth, glossy finish of these wheels adds a sales-brightening punch to lawn mower displays in hardware and department stores.

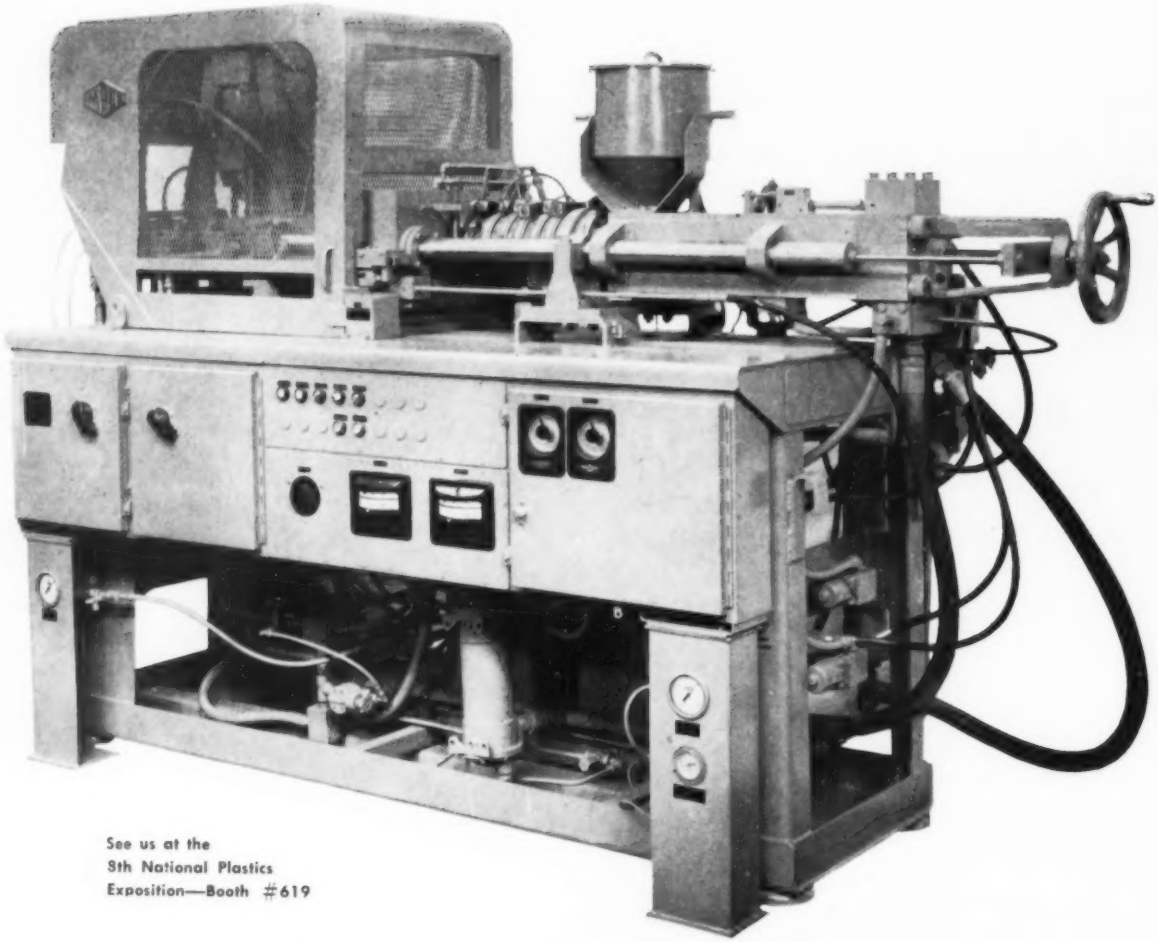
For more information on SUPER DYLAN polyethylene and these other fine plastics by Koppers—DYLITE expandable polystyrene, DYLENE polystyrene and DYLAN polyethylene—*wire or write Koppers Company, Inc., Plastics Division, Pittsburgh 19, Pennsylvania. TWX Call Number PG533*

DYLITE, DYLENE, SUPER DYLAN and DYLAN are registered trademarks of Koppers Company, Inc.
Offices in Principal Cities • In Canada: Dominion Anilines and Chemicals Ltd., Toronto, Ontario

KOPPERS

KOPPERS PLASTICS





See us at the
8th National Plastics
Exposition—Booth #619

ANOTHER NEW IMPCO

Special Purpose Injection Molding Machine for Containerlike Molding

MODEL CA30-75

- 30-50 gram capacity
- 30 molding cycles per minute*
- shut-off nozzle for pre-pressurized molding
- simplified mold construction
- built-in die and platen cooling arrangement
- separate injection and clamp hydraulic circuits
- shock mounted control panel
- photo electric recycling monitor
- 75 ton clamp
- 9¼" stroke
- fully automatic

*dependent on material and mold construction

IMPCO **IMPROVED MACHINERY INC.**

NASHUA · NEW HAMPSHIRE

In Canada, Sherbrooke Machineries Limited, Sherbrooke, Quebec

Curved roof of "Structoglas" panels, manufactured by International Molded Plastics, Inc., Cleveland, Ohio, at Morris Elementary School, Troy, Michigan.

NO WEATHERING WORRIES HERE!

These glass-fiber reinforced panels are made with PARAPLEX® P-444

The *superior weather resistance* of glass-fiber reinforced panels made with acrylic-modified PARAPLEX P-444 polyester resin is shown in the photomicrographs below. After THREE years of continuous outdoor exposure in Florida, PARAPLEX P-444 test panels show virtually no discoloration or fiber evidence. But notice the progressive degradation of the conventional light-stabilized resin!

For highest *quality* and *durability* in glass-fiber reinforced panels, at no increased cost, use PARAPLEX P-444. Write for complete technical details.

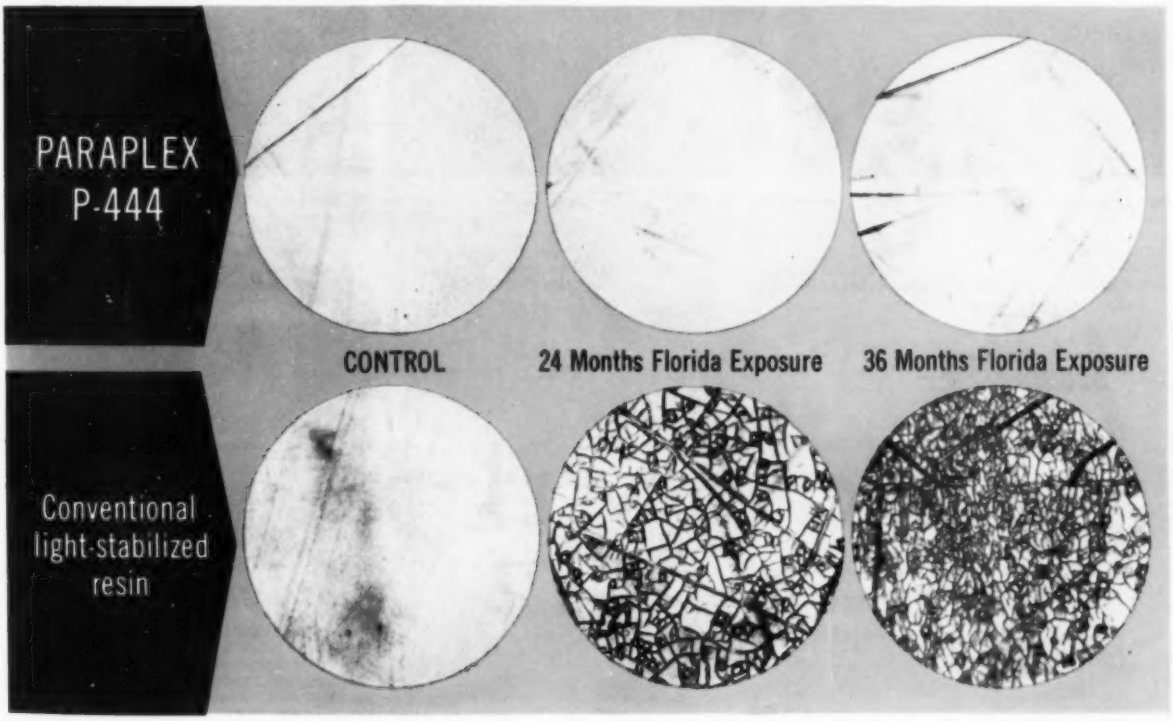
Chemicals for Industry

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

36-MONTH FLORIDA EXPOSURE TEST

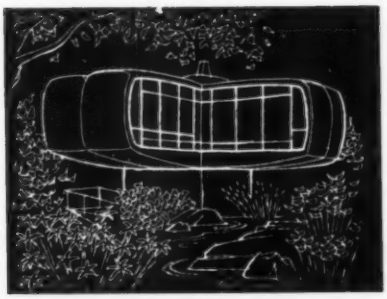


Structural uses for

AIRCOMB®

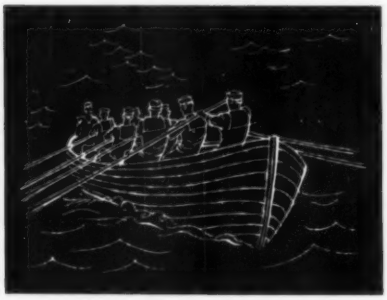
are multiplying

Faced with glass laminates or plastics, AIRCOMB honeycomb material provides the desirable combination of high strength, light weight, good insulation, resistance to corrosion and virtual elimination of maintenance

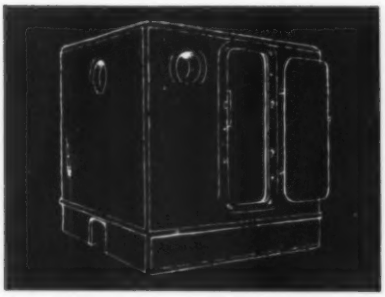


IN MODERN BUILDINGS—Aircomb is a primary structural element in the remarkable "Monsanto House of the Future," in Disneyland, California. Its strength, rigidity and outstanding insulation properties make it ideal for use in ceilings, floors, partitions and sliding doors.

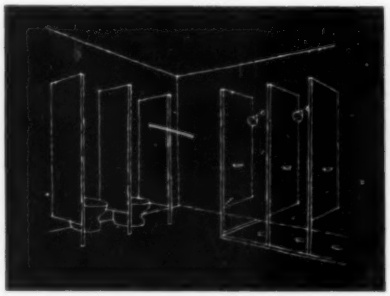
IN PLEASURE BOATS—Faced with glass laminates, Aircomb provides an unexcelled combination of rigidity and light weight for foredecks, hull bottoms and seats. Its freedom from maintenance problems and great resistance to shock are added advantages.



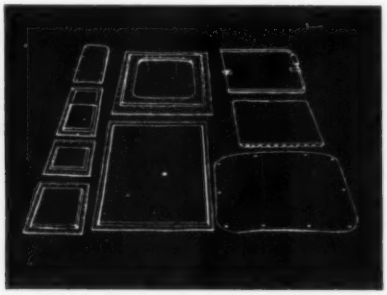
IN WORKING BOATS—Many U. S. Navy whaleboats employ Aircomb faced with glass laminates for flat surfaces and bulkheads. Both strength and rigidity are retained with a considerable saving in weight. The elimination of dry rot and rust are added advantages.



IN SEA CABINS—Cutting down weight above deck is helped by development of glass-laminate faced Aircomb sea cabins and other topside structures for Naval vessels. Designed to replace much heavier steel cabins, they have equal utility and superior corrosion resistance.



IN LAVATORY PARTITIONS—Faced with glass-laminate or decorative phenolic materials, Aircomb partitions resist both acid and corrosion. They eliminate the maintenance problems caused by corroding steel panels or chipping and rusting porcelain-enamel steel panels.

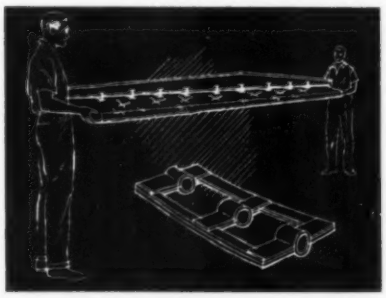


IN AIRCRAFT—Rigidity and light weight make Aircomb extremely desirable for aircraft tables, partitions, shelves and cabinets. On exterior applications (access doors), faced with glass laminates, it provides aerodynamically clean surfaces and eliminates need for stiffeners.

DOUGLAS

AIRCOMB®

a product of DOUGLAS AIRCRAFT COMPANY, INC.
3000 Ocean Park Boulevard, Santa Monica, California



IN AIRCRAFT TOOLING—Glass-laminate faced Aircomb is less affected dimensionally by moisture or temperature changes than any other material. As a pattern, it can transfer precise contours from master to die. Used for jigs, it can hold extremely close tolerances.

Don't miss . . . in this issue

The 8th National Plastics Exposition and the annual S.P.I. Conference in Chicago at the International Amphitheatre, Nov. 17-21. This will be the biggest plastics show in history, and the most interesting from the standpoint of new developments. For a preview of what to expect see our lead article beginning on p. 129. Complete program, list of exhibitors, and map of the show is an insert inside the front cover.

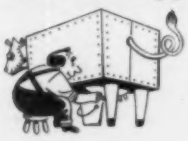
New TV picture tube is portable. Philco decided that the big box was a clumsy eyesore, so separated sound from picture with the use of a plastic housing trimmed with an unusual extrusion. See "Put the picture where you want it," p. 135.

Can thermoplastic screw caps compete? However, careful attention must be given to reducing cost of construction of the complex unscrewing molds needed to make caps. Components must be standardized designed to permit fast changeover from one closure to another. To see how it's done, turn to "Economics of unscrewing molds," p. 181.

Fair flowers in polyethylene are made by the molding process, look real, are washable, and nearly indestructible. Formerly imported, they are made here and enjoy a growing market. The story "Polyethylene blossoms," is on p. 139.

Cubic-inch costs of plastics and other materials over the past ten years are charted on p. 131. Here is a valuable sales tool for those who would use plastics for profits.

Milk sales upped 400% by the use of a simple, disposable polyethylene tube. Formerly milk was dispensed in half-pint cartons from automatic machines; now it is delivered to the machines in bulk, dispensed in cups—with great increase in sales. See "Milk dispensed by the cup," p. 176.



Miracle market in hoops. High-density polyethylene was a natural selection for extruded hoops. The market was bigger than ever expected. It has been a life-saver for extruders, accounting for over 7½ million lb. of material to date. Story on p. 146. See, also, editorial, p. 5.

How to make vinyl "pipe" from sheet. A simple but unique machine, pulled by a tractor, digs a trench, works vinyl sheet into a continuous arch, puts it in the trench and covers it up. Savings over previous drainage methods are tremendous. Read "New approach to drainage," p. 161.

Plastics in artificial eyes. Formerly blown from glass and laboriously and badly fabricated, those items are now made by an accurate process involving compression and injection molding and exact decoration. Techniques should be of interest to makers of other products, such as optics. See "Eyes to order," p. 143.

Watch for... the timely and important lead article in our December issue analyzing the rapidly changing picture in the plastics processing industries, the effect of the rise of the captive processor and how the custom people are reacting to this development in order to strengthen their position . . . the latest report on plastic films' phenomenal growth in agricultural applications . . . a comprehensive report on the latest in new resin developments—and what they foreshadow for the plastics industry at all levels . . . a detailed program of the 14th Conference of the S.P.I. Reinforced Plastics Div., which will be held in February 1959 . . . the second and concluding article on how to select the proper polyethylenes; this one taking a close look at film, pipe, wire coating, and other applications . . . some unusual uses of rigid urethane foam . . . news about a styrene-acrylonitrile sprayer which is going to compete with a sizable portion of the aerosol market . . . a rundown on the first commercial application of polycarbonates in this country . . . our fabulous January issue, completely redesigned for easier reading, which will again present an authoritative review of the plastics industry . . . all significant developments in machines and materials will be covered . . . tables, graphs, and charts will provide at-a-glance reference . . . a full and first-hand report on the tremendously successful 8th S.P.I. Conference and Exposition held at Chicago, November 17-21 . . . our February lead feature is going to take you on a trip through the country's largest automated reinforced plastics molding plant . . . in March our lead article will cover the urethanes; this is going to be definitive and will cover rigid and flexible foams, coatings, adhesives, elastomers—the waterfront . . . a major feature on decorating plastics, presenting a full-scale report on the latest techniques available to the industry to make its products more beautiful and usable.

MODERN PLASTICS
Volume 36
November 1958
Number 3

PLASTICS FOR PROFITS

The recent recession, with its attendant cost-profit squeeze in almost all kinds of end-product manufacture, taught many producers a valuable lesson: *Proper use of plastics can be the key to profits.*

This is why the theme of the 8th National Plastics Exposition is "Plastics for profits." This is why our pre-Show issue contains 30 case histories of plastics application in which products have been improved at the same or lower costs with plastics, new and better products have been designed directly in plastics, functions not before available are now offered because of plastics.

Lower material prices

The chart on p. 131, showing the 10-year record of per cubic inch costs of plastics and non-plastics materials, presents an important part of the story.

First, price trends in plastics over the past decade have been downward as production has increased. Second, plastics prices are not subject to the emotional and political strains of speculative commodity markets.

Third, a wider selection of properties is available in the whole field of plastics than in all other ranges of materials put together. And with reinforcements, alloys, copolymers, and combinations of plastics and non-plastics materials, this range of properties is widened even more.

There is no need here to repeat the list of plastics' properties. There is need to mention that developments within the last year or so made it possible to produce specially reinforced plastics components that will stand up to heats which would vaporize stainless steel. At the other end of the economic scale, new processing methods and lower prices have brought polyethylene film to the point of disposability—cheaper than paper.

Having established the price trends in plastics in competition with other materials, having assessed the per cubic inch cost comparison between plastics and non-plastics, and having recognized the tremendous range of properties available in plastics, how do they rate in terms of processing and assembly cost?

Plastics and processing

First, automatic molding, extrusion, and forming methods insure high-speed production.

Second, lower labor costs are obtained by the elimination of finishing and the simplification of assembly operations.

Third, plastics processes tend toward the elimination of rejects and in the thermoplastics rejects can be melted and re-worked.

Fourth, obviously the use of more and

larger components of plastics in any product cuts shipping weight.

Fifth, improved technology (see our Engineering Section beginning p. 181) lends new economy to plastics in cutting processing costs and speeding production.

Sixth, growing sophistication in design for plastics on the part of industrial designers and both product and process engineers is leading toward the use of various plastics in combination with each other and in combination with non-plastics to produce superior products with economy.

Finally, product designers, working with tool designers, are coming up with simpler parts engineering, permitting lower cost production.

This, then, is the background against which this 8th National Plastics Show should be studied. Every booth, every display, is tuned to the proposition that the proper use of plastics can lead to cost savings and, therefore, profit. Naturally visitors to the Exposition are interested chiefly in new materials, new methods, new designs, and new equipment.

Trends at the Show—materials

In the phenolics, new reinforcements and new alloys will be seen. Low-cost impregnated sisal mat, phenolic-epoxy blends, phenolic-nylon powders, ablative exotic phenolic combinations for missile work, and new premix materials for high-speed automatic molding.

In the melamines watch for improved techniques of decoration and a trend toward big piece molding.

The new polyester non-reinforced molding compounds in gorgeous colors are fast gaining a market and are well worth studying.

Wood flour-filled urea is back on the market made by a new process, and is a very economical material.

Advances in the use of epoxies, particularly for the construction field, will be generously displayed.

And what about the thermoplastics? In the acrylics watch for applications of the new acrylic sirups, particularly for decorative construction panels, and both acrylic-polyester and acrylic-vinyl alloys.

The acetates will be seen mainly in new forms of automatically-produced packaging and display items as well as new decorative sheet materials for the optical trade.

The ABS polymers will be seen in new molded industrial parts and machine components, and formed from sheet into luggage, automotive parts, furniture, and aircraft components.

Butyrate will be shown in new molded applications and in items formed from sheet.

Nylon in a wide variety of forms will be seen competing most favorably with die-cast metals where it is rapidly catching up. Big nylon pieces and heavy cross-sections, including barge propellers and big extruded stock, will be observed.

The polyethylenes, of course, will swarm all over the Show in all densities and forms, in huge tanks, some made by new methods, and in the new vacuum formed sheets.

Polypropylene will be present, with emphasis on its strength, heat resistance, and beauty.

Polycarbonates in commercial quantities will be announced with their extreme toughness and electrical properties emphasized.

In the styrenes look for new foams and methods of making them. Look also for new applications of the styrene alloys and of oriented sheet materials.

New rigid vinyl material with exceptional properties and cost-saving possibilities will be shown, as will new forms of extruded vinyl foams and new vinyl-coating materials.

In all materials, whether thermoset or thermoplastic, be ready for new forms of foams and new ways to use them.

Trends at the Show—machinery

On the machinery and equipment side, emphasis will be on automation and high speeds.

In injection molding, the small fully-automatic will be stressed, while in compression there will be bigger automatics than ever made before.

Extruders, too, will emphasize speed and capacity, particularly for the production of sheets and films. Considerable interest is expected in the developing extrusion-molding processes.

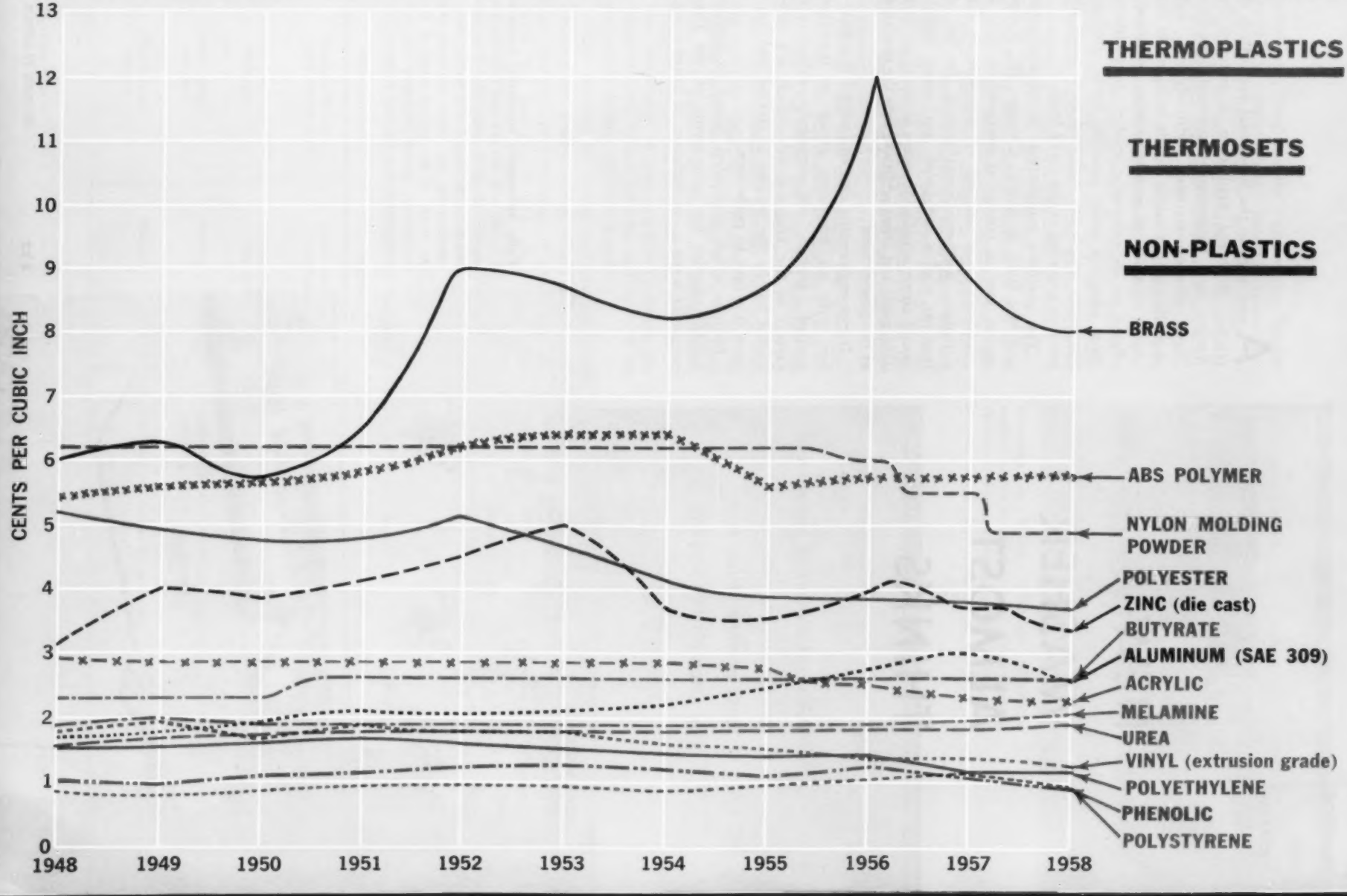
Much improvement over older models will be seen in coating and impregnating equipment.

Finally, as in other equipment, the trend toward automation in vacuum and drape forming will be evident.

It should be a tremendous Show, and visitors should come away from it with new ideas on how to use plastics for profits.—End

Ten-year record of per cubic inch in cost of selected raw materials. The basic chart out of which this was developed was the work of Dr. George L. Graf, Jr., Sales Technologist, Polychemicals Dept., Du Pont

COST PER CUBIC INCH OF PLASTICS AND OTHER INDUSTRIAL RAW MATERIALS



PLASTICS FOR PROFITS

NEW WASHER ALMOST THINKS

Detergent dispensing feature and cycle control for all fabrics made possible at low cost by using plastics properly

A new high in the functional application of plastics in home appliances is marked by Norge's new Dispensomat automatic washer. Three plastics—styrene, methylstyrene, and phenolic—play a major role in bringing to the unit a number of features never previously offered in an automatic washer. In addition, their adoption made possible lower production costs which are reflected in a more attractive price tag at the retail level.

The problem confronting Norge engineers and Mel Boldt & Assoc., Chicago, Ill., Norge stylist, was to create, at competitive cost, a completely new concept of convenience for automatic washers. Spearheading the list of features was a fool-proof mechanism which would automatically dispense as many as four detergents and other additives into the machine at the proper time.

Norge engineering met and solved this problem with an ingenious group of injection molded plastic compartments—collectively known as the Dispensomat—which are preloaded before the washer is started and perform this task to perfection.

Factors which persuaded Norge to specify molded plastics for components of the Dispensomat were a combination of lower costs,

Fully automatic laundering becomes a reality with Norge's new Dispensomat washer, which automatically dispenses powdered or liquid detergents, water conditioners, and other additives into the water at the proper stage of the cycle. Here plastic dispenser bins are preloaded before starting washer

permanent integral color which eliminated the need for supplementary finishing operations, durability, light weight, and the ability to withstand contact with a variety of detergents, water conditioners, and fabric softeners without damage.

Six components in dispenser

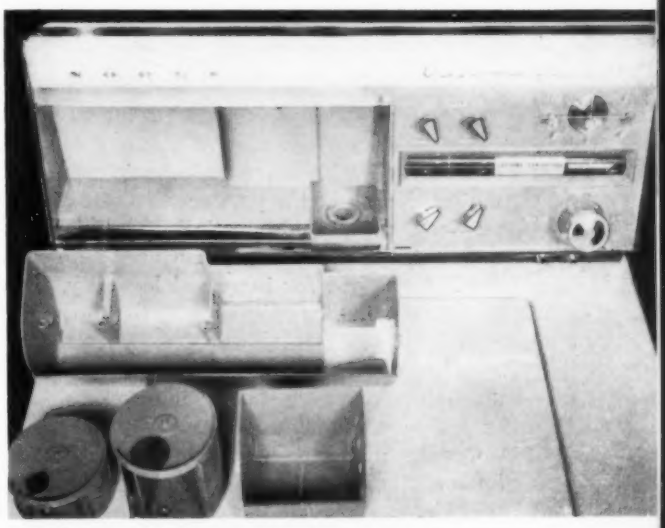
The dispenser feature is located behind a drop-down door at the left side of the backguard or control panel of the washer. The six injection molded components, produced by Modern Plastics Corp., Benton Harbor, Mich., include the liner, which mounts in the backguard of the machine, the dispenser body, two circular dispensing drums, a dispensing tray, and a drain receptacle. Of these parts, the two drums are molded of Cymac 201 methylstyrene material (for added heat resistance); all the other parts are of Dow 440 Styron high-impact styrene.

Of the four bins comprising the dispenser, two are for dispensing liquids and two for powders. One liquid bin and one powder bin empty their contents automatically during the wash fill; the remaining powder bin feeds during the first rinse fill. The second liquid bin releases its contents at the end of the final deep rinse. All dispensing operations are precisely timed by automatic controls. The two liquid bins, suspended so they are free to rotate, are designed with ballast pockets so they will tilt and empty as they fill with water.

Other noteworthy plastic applications in the Dispensomat washer which involved cost savings, superior performance, or appearance include the backguard face plate, the fabric guide assembly, and the dual-purpose agitator, which embodies a new operating principle.

The face plate covering the backguard is in-

Closeup of Model AWD-502 automatic washer shows the Dispensomat compartments (left) and the fabric washing guide, which may be seen through styrene face plate

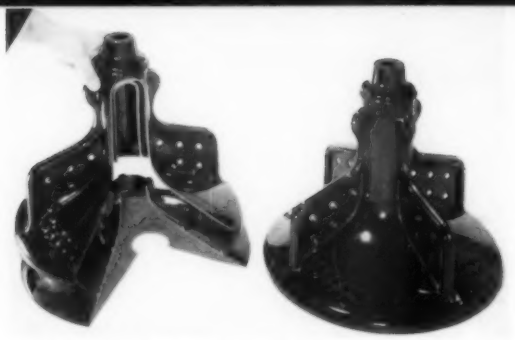


Injection molded parts for Dispensomat include liner and base receptacle, shown installed in backguard, dispenser body, tray, and two circular dispensing drums. Parts are of impact styrene and methylstyrene

Outstanding Plastics Applications in Norge Dispensomat Automatic Washer

Component	Material	Advantages
Dispensomat bins and related parts	Impact styrene and methylstyrene	Light weight . . . sturdiness . . . absence of finishing operations . . . immunity to corrosion . . . unaffected by detergents, etc.
Face panel for backguard	Styrene decorated on back surface	Light weight . . . convenient fabrication and decoration . . . excellent light transmission properties
Fabric guide cylinders	Styrene	Light weight . . . dimensional stability . . . low cost . . . adaptability to marking and decorating
Dual-purpose agitator	Phenolic	Unaffected by detergents, acids, etc. . . . integral color requires no finish . . . light weight . . . moldable in complex shapes . . . smooth surface friendly to fabrics

Fabric guide consists of two extruded styrene cylinders, one fitting within the other. Printed information on outer transparent tube (top) and red pattern on white inner tube (bottom) are silk screened onto vinyl film, which is cemented to the cylinders. Molded styrene end cap (right), is made in two parts



Dual-purpose phenolic agitator, made in two parts, has inner (lower) bell, which is assembled to the upper unit. Vanes molded into lower section provide centrifugal pumping action as agitator oscillates, driving water up through agitator and lint filter

jection molded of clear general purpose styrene by Michigan Plastic Products, Inc., Grand Haven, Mich., and is decorated on the reverse side. Styrene for this part is supplied by The Dow Chemical Co. and Foster Grant Co., Inc. Produced on a 20-oz. injection machine, the part weighs approximately 10½ ounces.

The back surface of the piece is smooth, except for horizontal corrugations extending the full length of the part across the top. The words "Norge," "Automatic," and "Washer," molded in relief on the back surface of the part, are hot stamped for increased legibility, then a white coating is applied across the top of the piece. All other markings are silk screened directly on the back of the part; none is molded in. This permits markings to be altered as desired without retooling.

Openings through the face plate for control knob shafts are drilled after molding, avoiding possible weld lines around the holes and also permitting relocation of openings if required. A single fluorescent tube lamp, mounted behind the top of the face plate, illuminates the entire panel by light piping.

Fabric guide

The unique fabric guide assembly, which immediately indicates to the housewife how the machine should be set for different types of fabrics, consists of two thin-section extruded styrene tubes, one mounted within the other. The inner tube has an outside diameter of approximately 1 7/16 inches. Turning a control knob on the backguard of the machine sets the guide to the correct fabric, after which the housewife sets the control pointers according to a series of dots whose position is correlated to fabric identity. Metal bead chains control the movement of the plastic cylinders.

The inner cylinder is extruded of white styrene; the outer of clear transparent styrene. Fabric designation, guide dots, and other markings which appear on the cylinders are silk screened onto vinyl film, which is applied to the outside of the cylinders with an adhesive. The cylinders must be extremely accurate in dimensions and concentric so that the markings fit precisely. Production of the fabric dials is by Neo Products Co., Chicago, Ill.

Phenolic agitator

The molded phenolic agitator for the washer, of somewhat revolutionary design, is produced by Modern Plastics Corp., using Bakelite and Durez agitator type material. It is molded in two parts; an inner "bell" mounts to the main agitator component by means of four self-tapping screws. Molding of the main section, notable for its extensive coring through both the skirt and the four vertical vanes, is done in a single-cavity mold on a 600-ton compression press.

This construction produces a hollow agitator having spiral vanes molded on the top surface of the lower bell. As the agitator oscillates, it acts as a centrifugal pump, intermittently pumping water up through the hollow interior of the agitator and out through a perforated metal lint trap mounted at the top.

The economics of this agitator in phenolic as compared to metal are quite interesting. If made of cast aluminum, it would have been more costly because of the additional machining and finishing operations required. Secondly, the metal agitator would be subject to pitting and pocketing by detergents, eventually resulting in a rough surface which would be hard on clothes and increase the mechanical load.

All in all, the Norge Dispensomat provides an excellent case history of how selected plastics can hold down costs while improving both the appearance and performance of today's highly engineered appliances.—END

PLASTICS FOR PROFITS

Put the picture where you want it

Striking new concept in TV, the separate picture tube, is made possible by big moldings of styrene alloy and butyrate, plus tricky extruded trim

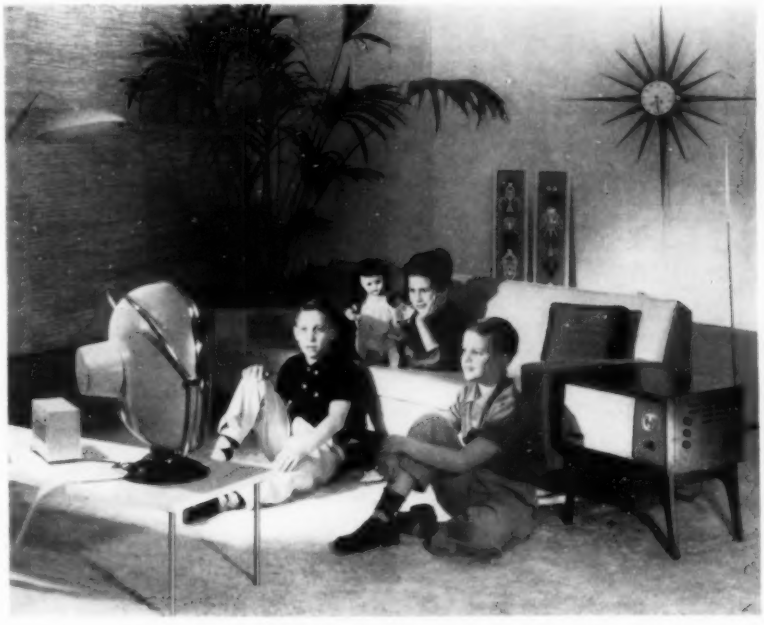
In what may foreshadow a renewed penetration of plastics into the TV market, Philco Corp. has turned to styrene alloy and butyrate in developing the three 21-in. Predicta models of its 1959 TV receiver line.

The new models present a sharp departure from conventional design: the separate screen. Instead of being housed in the traditional rectangular cabinet, the picture tube is a separate entity from the chassis; in one model, the two are connected just by a 25-ft. flat cable. In bringing the tube into the open, Philco called on plastics to the tune of about 6½ lb. for each television set.

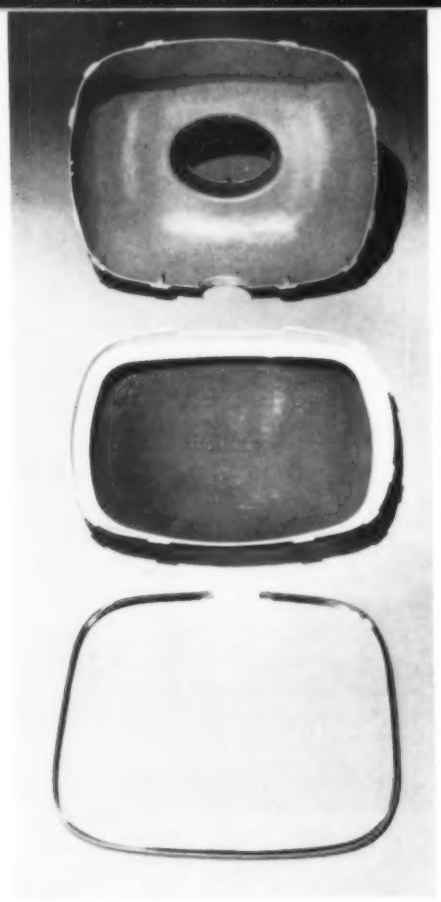
The picture tube of the new receivers is housed in a plastics shell. Two large moldings are used to encase the entire tube. At the front, a clear butyrate molding covers the face of the tube. It is a one-piece injection molding, tinted to minimize the glare. Eastman Chemical Co. supplies the raw material for this massive piece, which weighs 2 lb., 10 oz., and measures 22½ in. horizontally across the face by 18 in. vertically.

For the production of this butyrate part, sheet thermoforming and press polishing were

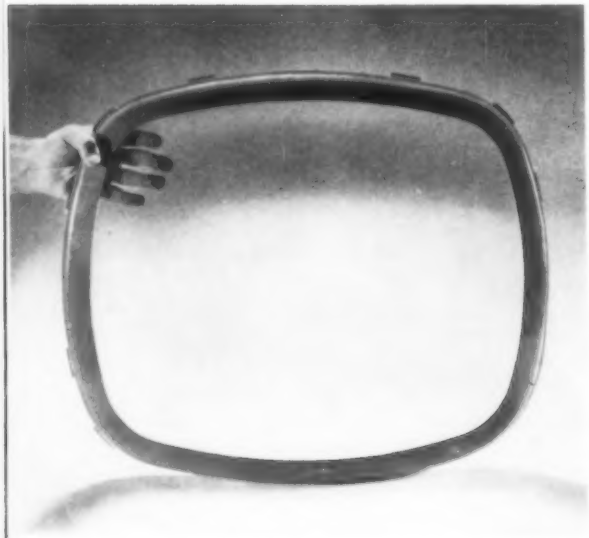
Pedestal-styled model TV receiver illustrates Philco's new design concept in which the plastics-housed picture tube is liberated from the rectangular cabinet



Separate screen of new model goes one step further —the picture can be placed anywhere in the room



Plastics parts of the tube housings for both models consist of two injection moldings—an impact-styrene back (top) and a clear butyrate face plate—plus a butyrate extrusion with metal foil insert as a trim strip



Face plate of butyrate is a one-piece injection molding with optical clarity. Dark strip around edge is printed green on reverse side. Weight of shot is 2 lb. 10 ounces

investigated, but clarity troubles were encountered. The smallest speck of dirt will show up in the large clear area. After molding, the inside "frame" of the part is painted a light green, which shows through the outside surface of the tinted part as a dull olive green. When installed, the butyrate molding gives the viewer the impression that he is looking at the bare face tube itself, adding to the impact of the design.

The rear part of the plastics shell is a light tan injection molding of styrene alloy supplied by Bakelite. This piece conforms closely to the contours of an extremely short-necked 110° picture tube (13 in. deep) developed by Philco. Weight of this part is 3 lb., 14 ounces. Both parts of the tube housing are molded by Plastic-Ware Inc., New York, N. Y.

Impossible without plastics

Without plastics, Philco's new design approach would have been economically impossible. Theoretically, the clear front plate could have been made of glass, but this was so prohibitive from the cost standpoint that Philco's design group did not investigate the matter very far. Besides, the weight of the glass would have required a heavier base to hold the assembly, reducing the light buoyant quality of the design and adding to shipping costs.

For the rear part of the tube housing, the possibility of using an aluminum die casting was examined, but again cost considerations led to the choice of plastics. Aside from the cost considerations, an important virtue of both plastics used is that they provide excellent electrical insulation as an extra safety measure.

Picture tube assembly

In assembling the picture tube components of the Predicta receivers, the glass tube is held to the base by means of a metal strap. The plastics moldings are then slipped over the tube and held in place with another metal band, which locks around a series of mating projections on both of the plastics parts. Over this band is placed a trim strip of extruded butyrate with an aluminum foil insert.

This trim strip, supplied by Anchor Plastics Co., Long Island City, N. Y., is post-formed on specially designed equipment to conform to the shape of the housing. It is held in place by means of a spring clip, attached to two eyelets in the extrusion, which anchors the strip to the base of the assembly. The extrusion closely matches the color of a metal rod which is lo-

cated around the Tandem model and serves as a handle for moving the picture tube about the room.

Housings of TV receivers must be completely safe in use. If the cathode ray tube should be broken, the housing must be capable of withstanding the effects of the violent implosion that would take place. In its tests, Philco cut a hole in the top of the tube housing, and then dropped a steel bar directly onto the tube. Results showed that the housing safely contains the force of the implosion.

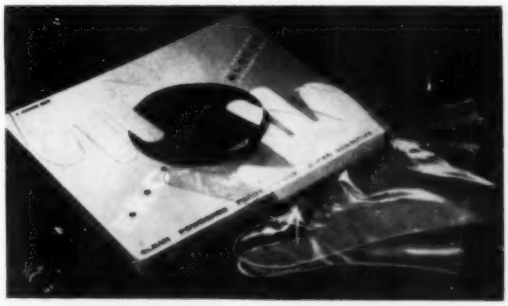
Though Philco will not reveal sales figures, the company reports that response to the Predicta models has been excellent and much higher than anticipated on both the distributor and dealer levels. These models may be the forerunner of a major trend in TV cabinet design, in which the plastics industry could look forward to greatly increased business.—END

Disposable gloves

Tremendous savings to industry and a big future in many markets seen for new polyethylene film products

Fabricated by heat-sealing two sheets of thin gage polyethylene film, disposable gloves are promising to effect significant economies to industrial, food handling, medical, and other end users. Intended as a replacement for rubber gloves, the polyethylene product is aimed at those applications where hygienic and cleanliness factors make protective hand-covers mandatory.

Savings brought about by the use of the polyethylene gloves can be substantial. Carl H. Biggs, president of Biggs Co., Los Angeles, Calif., distributor of one line of polyethylene gloves, states that they "pay for themselves many times over by cutting clean-up time losses to a minimum, especially on messy production jobs in-



Four-finger gloves packed in special carton (both produced by Milprint), are suggested for use by doctors, veterinarians, barbers, etc.

Gloves fabricated by Plasticsmith are dispensed from roll of paper carrier; have proved effective in many industrial applications

volving bonding, potting, coating, and the like. One firm, formerly providing rubber gloves to its assembly lines switched to [the new gloves] at a saving of over $1000 per month."

Who is in the field

Companies active in the field include Plasticsmith, Inc., Pittsburg, Calif., and Milprint, Inc., Milwaukee, Wis. The first company makes the five-finger Handgards, for which Biggs Co. is a distributor. The second firm produces a four-finger variety, which is distributed to the medical and pharmaceutical field by Emergency Kit Corp., New York, N. Y.

Price per glove varies from 3 to 9¢, depending on type, gage, and quantity. This is less than half the cost of the cheapest suitable rubber varieties. The polyethylene gloves are sold in small, medium, and large sizes; they come packaged in rolls (on a paper carrier) of 12 to 1000 gloves, or in cleaning-tissue-type dispenser holding up to 144. The material used is conventional low-density polyethylene film; gage varies from 1 to several mils.

Propertywise, the new gloves offer several advantages: they are waterproof and lightweight; while strong, they are thin enough to give the user an excellent sense of touch; they are resistant to acids, solvents, and most chemicals; ventilation is provided by flared wrists, which can be sealed by a rubber band when the hand has to be immersed completely. And although inexpensive enough to be disposable, the polyethylene gloves are also strong enough to be reused.

Although the greatest area of saving is in the industrial field, the gloves have established a firm foothold in hospitals, laboratories, beauty and barber shops, and similar service markets. Physicians have found the four-finger 1-mil variety especially useful, convenient, and economical.—END

Underwater camera

ABS plastic unit withstands pressures at great depths, sells for one-third the price of other models

An inexpensive underwater camera that can be used at depths up to 100 ft. is being produced by Healthways, Inc., Los Angeles, Calif., from Kralastic, an ABS polymer blend material supplied by Naugatuck Chemical Div., United States Rubber Co. The plastic material was selected for this application because it is tough enough to stand up under deep water pressure and accidental dropping on swimming pool concrete, and is resilient, corrosion resistant, and low in cost. The new camera, designated Mako Shark, retails for about $35, which, according to U. S. Rubber spokesmen, makes it the most inexpensive underwater camera available. This price is approximately $65 less than any other models currently on the market.

All exterior parts of the camera are made from the acrylonitrile-butadiene-styrene blend. The case is injection molded in four sections. A gun-sight viewfinder and a molded-in grip are made of the same material. Rubber "O" rings are used to obtain water-tight seals, and the molded parts are cemented together. The camera mechanism itself is adapted from standard commercial parts.—END

All external parts of underwater camera are molded of ABS polymer blend. By using plastics, camera is least expensive of its type

Polyethylene blossoms

Injection molded flowers that will last indefinitely are reducing both the cost and headaches of display managers and decorators

The beautiful flowers pictured here are not fresh from the garden; their seeds were planted in the hopper of an injection molding machine and they were brought into bloom on an assembly line.

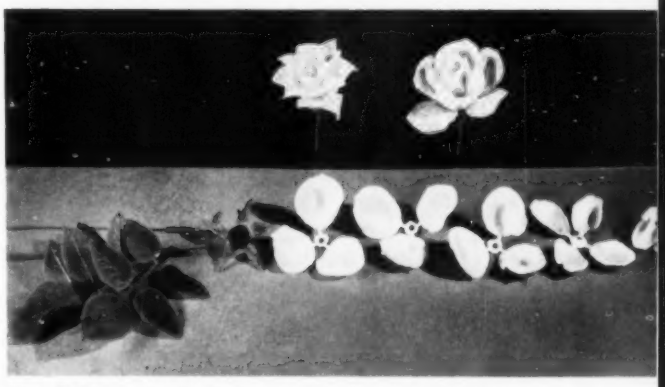
Molded of polyethylene by Art Plastic Co., Woodside, N. Y., these blossoms are a real boon to the display field because of their infinitely long life compared with real flowers, and even wax flowers, which often do not survive the first washing.

At present, 11 different flowers are manufactured, and more are planned. Each polyethylene blossom vies with the real thing in color and general appearance. The flowers include carnations, chrysanthemums, cosmos, crocuses, African daisies, common daisies, jonquils, lilies-of-the-valley, roses (which come in four sizes), tulips, and parrot tulips. In addition to these flowers the company molds six different ferns, authentic in shape and color, to make up floral displays, as well as philodendron, ivy, apple blossom, and holly sprays.

The flowers are made up from separate injection molded sections; these are hand assembled to an extruded stem of green polyethylene which is reinforced by a wire insert. Injection molded leaves for the stems help to complete the realism. The different ferns are molded in one shot around a wire mold insert for stiffness. The ivy lengths consist of leaf sections, which are assembled to an extruded green stem.

Art Plastic Co. designs all its flowers and makes its own molds for them. Fast and inexpensive mold making is a key factor in the company's success, since the operation involves a whole botanical garden of molds. Some of the flowers have as many as 10 different sections, each requiring a different mold cavity.

The polyethylene flowers are being sold through the display field and floral jobbers, as well as through variety and department stores. They should brighten up many a cocktail lounge and restaurant this winter, besides adding color to private homes.—END



Breakdown of polyethylene rose in foreground shows individual injection molded parts. The blossom consists of five white moldings (at right), graduated in size. Injection molded leaves are at left. In the background is an assembled plastic rose which is practically indistinguishable from the real flower next to it

Molded polyethylene flowers that challenge the real thing in appearance not only last indefinitely but also survive washing in hot water. Eleven different flowers are currently available. (Photo, Eastman Chemical Co.)

PLASTICS FOR PROFITS

Compactly designed automatic slide viewer owes much of its marketing success to profuse and proper use of plastics

Designed to compete

Portable slide viewer wins in a tough market by clever design using eight different plastics

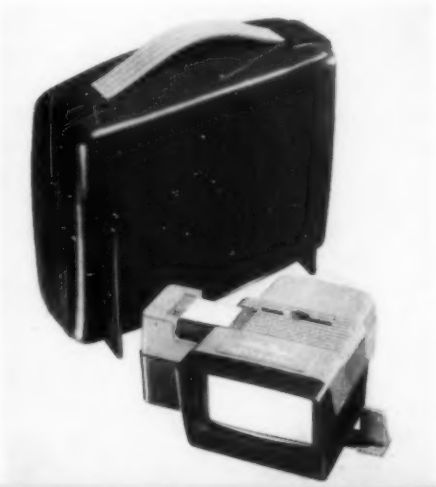
Production economies and appearance considerations led Airequipt Mfg. Co., New Rochelle, N. Y., to choose plastics for its first mass-market consumer product, the Ultramatic slide viewer. This hand-operated, portable instrument incorporates a unique slide changing feature. The push-pull action of an operating lever takes a slide from a loaded magazine, moves it into viewing position, turns on a light for viewing, shuts it off, moves the slide out of the viewing plane, returns it to the magazine in its proper sequence, and moves into position to bring out the next slide.

The viewer market is a highly competitive field. At least 25 firms are actively engaged in it. In order to take full sales advantage of the unique changer mechanism, Airequipt management called for a design that would place the unit in the medium-price bracket. The requirements specified within this price range were: 1) Minimum cubic volume. 2) Heat resistant lamp housing. 3) Close-tolerance construction to assure proper functioning. 4) Prevention of reflections on viewing screen. 5) Attractive styling. 6) Break and shatter resistance. 7) Matching carrying case and magazine.

The appearance design of the unit was developed by industrial designer Roger Mark Singer, ASID, in close cooperation with Airequipt engineers. Three basic approaches were considered: die-cast aluminum, coated sheet metal, and molded and fabricated plastics.

A die-cast aluminum unit would be more expensive because it would have to be produced in a larger number of smaller components (in-

(*To page* 142)

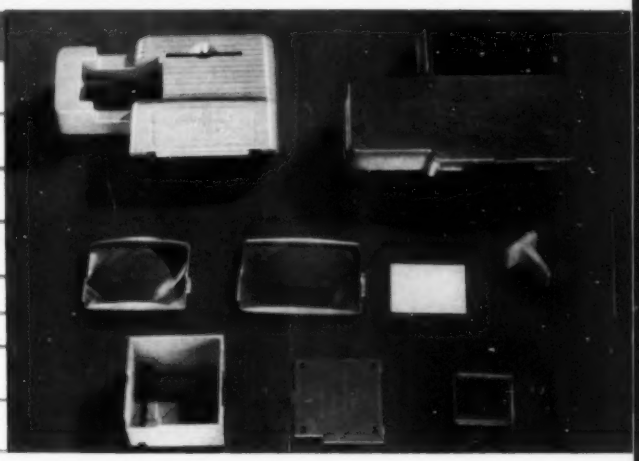


Viewer and matching carrying case. Case is designed to hold five extra slide magazines. For complete parts list, see facing page

Details of Plastics Parts in Ultramatic Slide Viewer

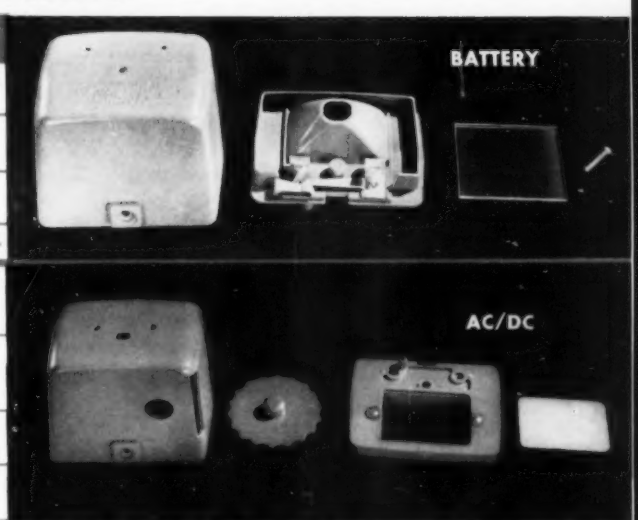
VIEWER HOUSING AND MAGAZINE

Part	Weight, oz.	Material	Supplier	Molder or fabricator
Upper viewer housing	3.2	Polystyrene 475	The Dow Chemical Co.	Shaw Insulator Co. Irvington, N. J.
Lower viewer housing	5.0	Polystyrene	The Dow Chemical Co.	Shaw Insulator Co.
Lenses (front and rear)	2.6	Acrylic	Rohm & Haas Co.	American Optical Co. Southbridge, Mass.
Diffuser	0.02	Butyrate	Eastman Kodak Co.	The Sillcocks-Miller Co. Maplewood, N. J.
Handle	0.09	Polystyrene	The Dow Chemical Co.	Shaw Insulator Co.
Magazine	0.7	Polystyrene	The Dow Chemical Co.	Shaw Insulator Co.
Magazine cover	0.2	Polystyrene	The Dow Chemical Co.	Shaw Insulator Co.
Index card cover	0.01	Triacetate	Eastman Kodak Co.	The Sillcocks-Miller Co.



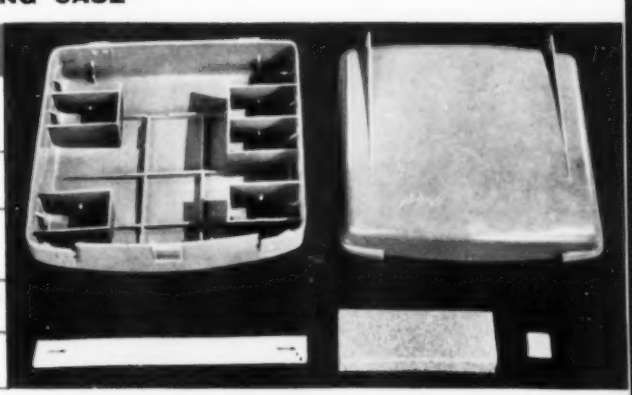
LAMP HOUSING

Part	Weight, oz.	Material	Supplier	Molder or fabricator
Switch button	0.005	Nylon	Du Pont	Gries Reproducer Corp. New Rochelle, N. Y.
Reflector	0.8	Polystyrene 475	The Dow Chemical Co.	Shaw Insulator Co. Irvington, N. J.
Battery light housing	2.0	Polystyrene	The Dow Chemical Co.	Shaw Insulator Co.
Diffuser	0.13	Polystyrene	Plax Corp.	The Sillcocks-Miller Co.
Rheostat knob for ac/dc housing	0.16	Polystyrene	The Dow Chemical Co.	Shaw Insulator Co.
AC/DC light housing	2.0	Urea	Plastics and Coal Chemicals Div., Allied Chemical	Shaw Insulator Co.
AC/DC cover plate	0.8	Urea	Plastics & Coal Chemicals Div.	Shaw Insulator Co.
Diffuser	0.12	Acrylic	Rohm & Haas Co.	Cast Optics Corp. Hackensack, N. J.



CARRYING CASE

Part	Weight, oz.	Material	Supplier	Molder or fabricator
Case bottom	12.0	Polystyrene 475	The Dow Chemical Co.	Majestic Molded Products Co. Bronx 54, N. Y.
Case cover	7.0	Polystyrene	The Dow Chemical Co.	Majestic Molded Products Co.
Handle	1.0	Vinyl	Various	Auburn Button Works, Plastics Div. New York, N. Y.
Cover pads	0.10	Polyester foam	Hudson Foam Products	Hudson Foam Products Yonkers, N. Y.
Push button	0.08	Polystyrene	The Dow Chemical Co.	Majestic Molded Products Co.



creasing assembly cost), would require considerable finishing, and would weigh more (increasing shipping costs). Fabricated sheet metal would have required a secondary chassis and costly edge finishing.

Once plastics were decided on, development work proceeded through its usual stages. Time from first design to prototype model was about a year. Before molds were cut, a study model was fabricated to mold specification. During this step, most molding problems were anticipated so that sample molding requirements were held to a minimum. Only one undercut is involved. Parts are designed to involve a minimum of assembly time.

The viewer has been on the market for about a year and is selling at an annual rate of about 100,000 units. The viewer itself retails for $15, the carrying case for $5, and the magazines for 50¢ each (there are eight magazines in a set). A "Recommended" rating by Consumer Union has aided consumer acceptance.—End

Slides in two minutes

Molded fixing-bath tank and mounting frames contribute to production economies of new Polaroid system

A new photographic system that produces black-and-white transparencies, framed and ready for projecting in a matter of minutes, incorporates two important molded plastics components: a fixing bath tank, tradenamed Dippit, and mounting frames. Property and cost considerations were the deciding factors leading to the choice of plastics for these components. Any other material would have increased cost without immeasurably improving the properties.

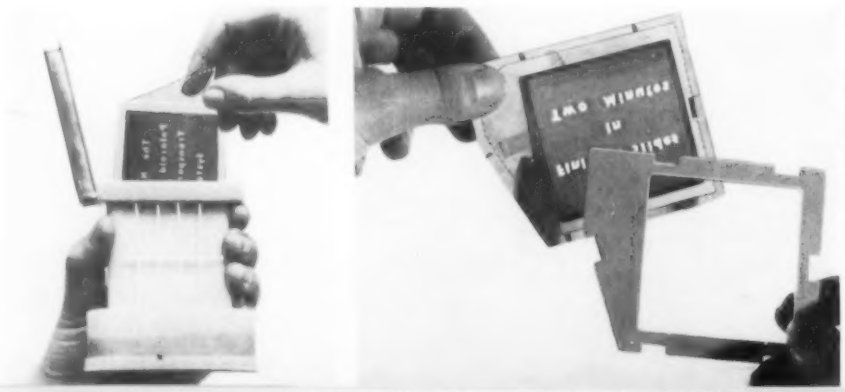
The system, introduced by Polaroid Corp., Cambridge, Mass., operates as follows: to make a slide, the user snaps the picture with a Polaroid Land camera loaded with a special film. Two minutes later he removes the developed transparency and places it in the tank where the emulsion is hardened to prevent fading and discoloration of the slide. Immediately after removal from the tank, the slide can be mounted, ready for projection.

The Dippit tank is injection molded of regular low-density polyethylene (Alathon 10, Du Pont) in a single-cavity mold; shot weight is 1.3 ounces. Molded-in ribs along the sides provide necessary rigidity. Light weight, chemical resistance, resilience, and minimum of assembly operations were the factors that led to the choice of polyethylene.

The mounting frames are injection molded of heat resistant polystyrene in mating halves in a multi-cavity mold. Molded-in lugs of one frame half snap into notches in the other to provide a secure mounting.

The tanks are molded by Foster Grant Co., Inc., Leominster, Mass., and The Morningstar Corp., Cambridge, Mass.; the slide mounts by Prolon Plastics, Div., Pro-phy-lac-tic Brush Co., Florence, Mass.

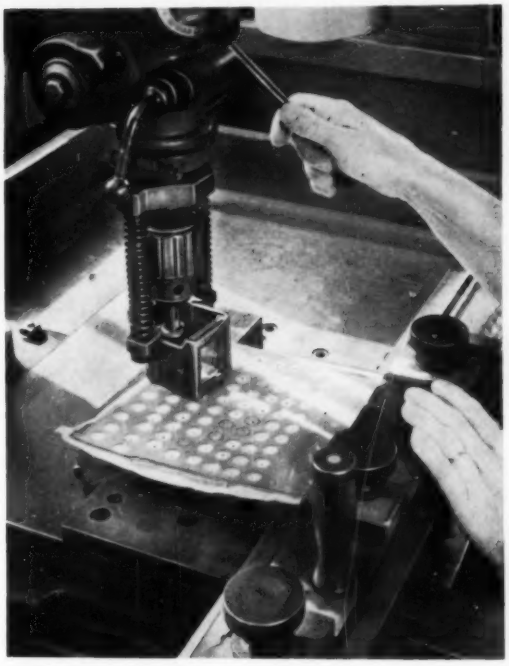
Prices are: Dippits—$1.10 (2¼ by 2¼), $1.40 (3¼ by 4); slide mounts—$1.50 (2¼ by 2¼), $1.75 (3¼ by 4), per box of 16.—End



Tank for film hardener (extreme left), molded of polyethylene, and mounting frames, molded of polystyrene, play an important part in the development and marketing of an "instant transparency" system

White base of artificial eye is injection molded of methyl methacrylate

Iris disks are cut from methyl methacrylate sheet



Eyes to order

New skills in art and processing permit acrylic to replace glass in artificial eyes

For a number of years, almost all the artificial eyes made in the world were produced in glass by German craftsmen, with the secrets of the trade being handed down from father to son. With the advent of World War II, the supply of artificial eyes was cut off and a replacement had to be found. Methyl methacrylate was the answer. By far the best material ever used for the purpose, acrylic is now used exclusively by artisans in the Monoplex Dept. of American Optical Co., Southbridge, Mass. This is rated as one of the largest artificial eye laboratories in the United States, and it is regarded by many as being one of the foremost in the world.

With the introduction of acrylic eyes, new techniques were developed, and wearers of artificial eyes began to enjoy a comfort never before obtained. The material is light in weight, will not break, and the size of a finished eye can be reduced or increased at any time. In addition, while acrylic eyes—selling for $35 to $150—are more expensive than glass eyes, they have a far longer life. Glass eyes have a life expectancy of one to two years; acrylic from six to eight years.

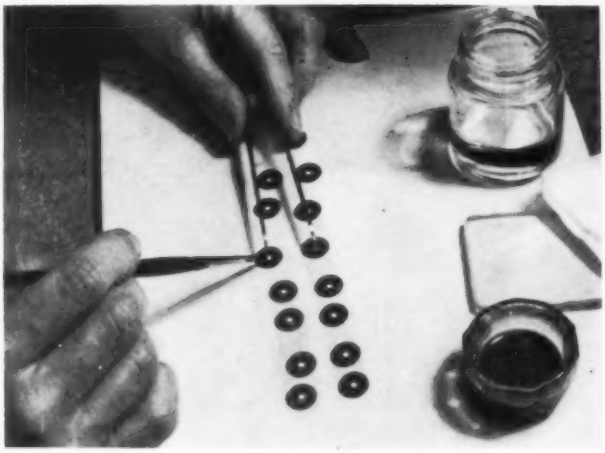
Sitting for the artist

Producing a custom-made artificial eye at the Southbridge laboratory is a work of art. The patients frequently sit for the artist just as one sits for his portrait. During the sitting, which averages two hours, the artist copies the details of the good eye. In the finished artificial eye, the coloring is not placed on one plane, or in one layer, but on several. By building up the plastic in layers, adding various features as the work progresses, real depth of coloring is obtained.

The matching of the veins in the original eye is a precise operation. To duplicate the depth and fineness of nature's handiwork, the sheerest of natural filaments are used, with dozens being carefully placed on the scleral portion of a single artificial eye by a veining specialist. Clear plastic is eventually overlaid on these,

Pattern is formed by imprinting iris disk

Iris disk and white base are assembled in position with a grey pigmented monomer-polymer dough



Backs of iris disks are painted, using mineral pigments in monomer-polymer sirup

simulating the subsurface characteristics of human veins. The main steps in the fabrication of acrylic artificial eyes are shown here.

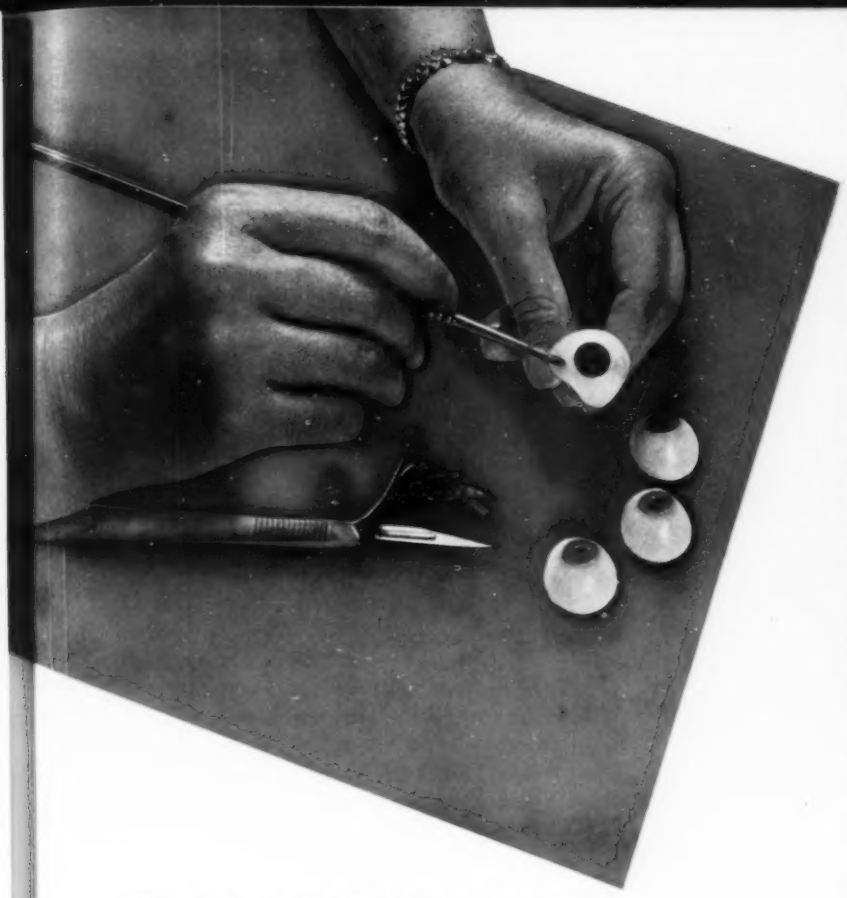
In selecting the correct eye for a given patient, it is generally possible to begin with one of the many standard shapes and colors. American Optical lists 75 stock colors in 18 different basic shapes. This means that the doctor has 1350 eyes from which to choose. After the basic shape and color have been picked, each eye is then individually handled, with one artist painting the details of the iris, or colored center, another putting in the veins, a third fabricating, a fourth adding the scleral characteristics, and a fifth doing the fitting.

Eyes from catalogs

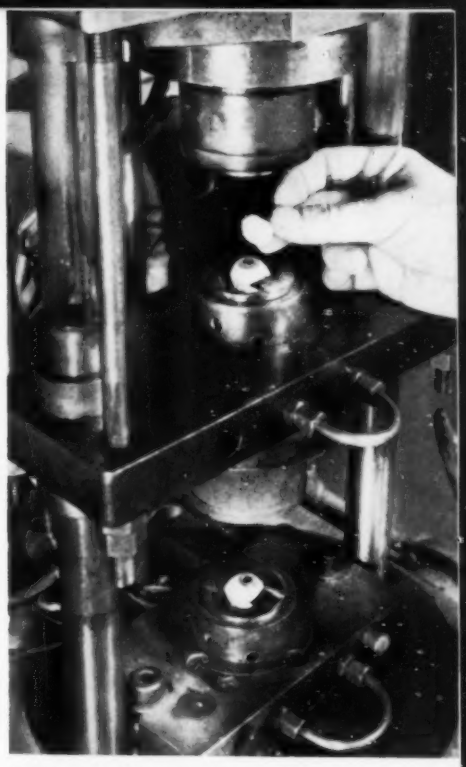
Through a complicated code system, doctors throughout the world can select any eye from the vast stock by means of color charts and catalogs, picking the model that is closest to his patient's remaining eye. Frequently an eye doctor, or ophthalmologist, will refer his patient to the laboratory in Southbridge, where the experts will fit the patient according to the doctor's wishes. In this way, the doctor may prescribe for his patient, while making use of the company's facilities.

As a result of its work in the field of artificial eyes, the laboratory has become one of the few training centers for eye fitters in the United States. Practitioners come here from all over the country to learn the latest techniques and methods in what is medically known as ocular prosthetics.

For an occasional change of pace, the laboratory is called upon to use its artistry in the production of cosmetic cover lenses. These are plastic shells, similar to contact lenses, and are often used by theatrical people. Through the



After top of iris is painted with a thin, translucent mixed pigment—so that base color shows through to obtain depth in color—natural fibers are applied with monomer-polymer sirup to simulate veins



Clear plastic overlay, which imbeds all art work and forms the cornea, or front curve of eye, is applied by compression molding

Removing flash and shaping the eye before final finishing operations

use of these, a blue-eyed leading man in a Technicolor movie can be cast as an authentic Indian, merely by the insertion under the eyelids of a brown-eyed cover lens. For the sake of vision, a small clear area is left in the center of the pupil. More serious uses of the cosmetic cover lens are for the covering of scars or the correction of vision.

It is estimated that one person in 500 wears an artificial eye, but that one in 300 should. Despite the number who do wear them, the reproductions are so excellent today that it is doubtful a layman could detect an artificial eye when being worn. Through correct fitting, these eyes can move in a manner that closely simulates the actions of real ones. There have been numerous cases recorded where a person's close friends have been totally unaware, during his lifetime, that he was wearing an artificial eye.—END

Final polishing, using a wet pumice

PLASTICS FOR PROFITS

Bonanza for extruders

Hoop fad boomed use of high-density polyethylene, taught many processors how to use it

Hoops—the largest application for high-density polyethylene to date—could never have been foreseen in any market analysis. The hoop craze raced across America this summer and was expected to consume an estimated 10 million lb. or more of high-density polyethylene by the end of the year. The fad took a still-new plastic material which was undergoing careful and methodical sales development and overnight pushed it into big-volume extrusion. By the time the fever was at its height, scores of extruders had been educated in the use of high-density polyethylene and were running it on a routine basis. Thousands of laymen had been made aware of the new plastic. Hoops greatly speeded the wide-scale debut of high-density polyethylene, and most sales estimates for 1958 have had to be revised upward.

Photo, Hercules Powder Co.

The hoop fad was a great production challenge. Large extrusion capacity had to be marshalled overnight to meet the demand—and it was. High-density polyethylene is just right for hoops. It makes hoops that are not too flexible, not too rigid, and are safe for children. Because it floats, it is just right when hoops are used in water games.

Wham-O Manufacturing Co., San Gabriel, Calif., started the first hoops rolling. They were handsome, two-color products, made by feeding two extruders through the same die. Weight of the 3-ft.-diameter hoops (113-in. long extrusion) averaged 10 oz., with wall thickness of 0.068 inch. A tapered wooden dowel joins the ends of the extrusion, while staples fasten the polyethylene to the dowel.

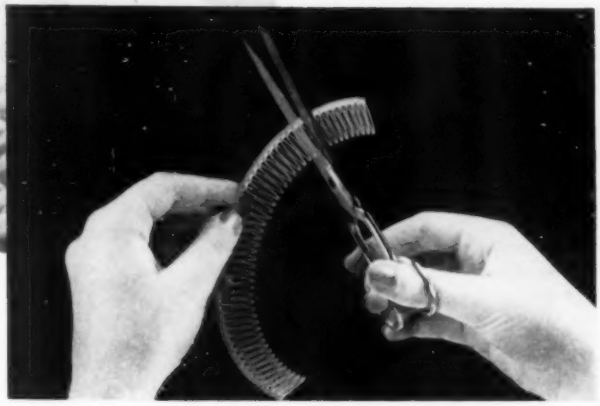
As hoop fever spread eastward from California, new companies entered the field all the way along. Dozens of toy companies and extruders got into the picture, as well as every supplier of high-density polyethylene. Some hoop producers started shaving away at price (it started at $2), and quality. Some hoops produced weighed as little as 6 oz., and were made from scrap material and used straight wooden dowels, which created stress in the material and reduced the life of the toy. (See "The golden-egg goose," p. 5 of this issue.)

Even so, production could not keep pace, with children everywhere demanding hoops. In early September vendors expected to sell an estimated 20 million hoops worth $30 million retail by the end of the year.

The first hoops went on sale in New York early in August, and a week or two later extruders in the area were working three shifts a day to meet the demand. Some extruders paid triple time on Labor Day. In full swing, production in the New York area topped 600,000 hoops a week, and Wham-O alone had sold two million hoops. One supplier of high-density polyethylene had sold more than three million lb. to 50 companies by Sept. 10.

At this writing, there is still no end in sight for the hoop bonanza. But already hoops have brought scores of extruders an unlooked-for business boom, and helped launch a new material for the plastics industry.—END

Polypropylene comb, cut by user to desired size, combines stiffness and resiliency required to keep the hairdo in place



Molded comb, sold in semi-circular shape, can be cut with a pair of scissors to any length demanded by hairstyle requirements

Cut your own combs!

Newest commercial plastic, polypropylene, used in hair styling device

By turning to polypropylene, Diadem, Inc., Leominster, Mass., has been able to develop a better product at a lower price. The product is the Hairtainer, a multi-spring comb adaptable to any hair style. According to Hercules Powder Co., producer of Pro-fax polypropylene, this represents the first commercial application of this particular material in the fashion field.

In a radical departure from conventional comb manufacture, Hairtainers are injection molded in a complete circle about 5½ in. in diameter and 17 in. in circumference. Special molds that allow for the shrinkage of the material are used. After molding, the circular comb is cut in half, and each half sold as a Hairtainer.

What makes the comb possible is the unique combination of resilience and rigidity characteristic of polypropylene; because of it the comb is stiff enough to maintain the shape and style of a hair-do, yet sufficiently flexible for easy manipulation. At the same time, the material is also soft enough to be cut by an ordinary pair of household scissors. Thus, the customer can cut any desired length from the 8½ in. comb to meet any particular coiffure requirements.

One semi-circular Hairtainer retails for 39 cents. This compares with 15 to 25¢ each for standard cellulosic-based combs. Since one Hairtainer can be easily cut into as many as 5 serviceable combs, price per comb is about half that for equivalent combs on the market today.

The comb has just been introduced, and reliable sales forecasts are not yet available. However, yearly sales in the millions are anticipated.

It is not expected that the polypropylene comb will completely replace acetate and nitrate units now available—despite its lower price and good properties. Prime reason is the limitation of finishes available to polypropylene. The Hairtainers are molded in shell, blonde, and natural.—End

PLASTICS FOR PROFITS

Injection molded nylon cyclone tube (left) and helix vane units have replaced metal parts in Donaldson dry-type air cleaners. Helix vanes are force fitted onto aluminum outlet tubes directly at the molding press

Air cleaning made easy

Switch from metal to molded nylon parts in heavy-duty air cleaner

improved product, simplified assembly

Important cost savings . . . simplified assembly operations . . . "built-in" resistance to corrosion. These were the principal advantages gained by Donaldson Co., Inc., St. Paul, Minn., in switching from metal to molded nylon for two functional components in the company's Donaclone dry type air cleaners, widely used on engines in tractors, off-highway trucks, rock crushers, and other equipment operating under conditions of severe dust concentration.

Parts involved are cyclone tubes and helix vanes, which perform the primary dirt removal job as air is drawn into the cleaner by the engine. The thin-walled nylon tubes are 1½ in. in diameter and approximately 6½ in. long; the helix vanes are basically 1⅛-in long sections of a hollow screw with broad, almost paper-thin flights. A single Donaclone air cleaner may incorporate as many as 113 cyclone tubes and vanes, involving up to 7 lb. of molded nylon. These components are injection molded for Donaldson by Minnesota Plastics Corp., St. Paul, Minn., using Zytel 101 material.

How it works

In the finished unit, each cyclone tube has a helix vane positioned in the top of the tube, with an inner aluminum tube passing through it. Dust-laden air, drawn into a sealed chamber forming a common inlet to the Donaclone tubes,

enters them and is set in rotation as it speeds past the fixed helix vanes. Centrifugal action forces dust particles to the outside. Spiraling down the coned lower section of the tubes, the air reverses direction at the bottom, ejecting the dust into a removable cup.

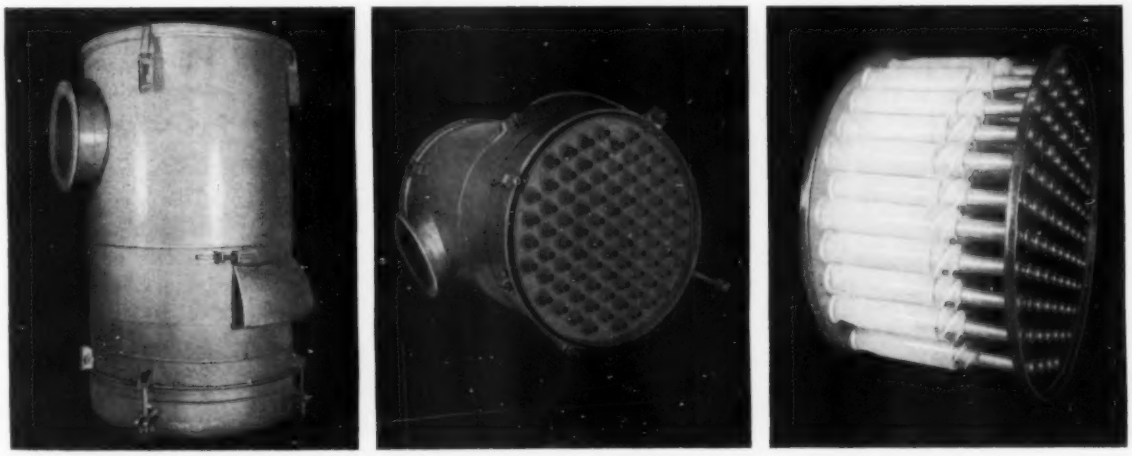
The importance of efficient dust removal for heavy-duty vehicles and other equipment may be appreciated from a look at the dust concentrations in which some of them operate. Per cubic foot of air, a farm tractor encounters about 10 times as much dust as an over-highway truck, and earth moving vehicles three times as much as the average farm tractor. Rock-crushing plants are exposed to more than five times the dust concentration to which earth-moving vehicles are subjected. With cost of an engine overhaul for some of this equipment ranging from $1000 to $3000, and considering the fact that engines can be ruined in a single day due to improper dirt protection, the need for thorough air cleaning becomes sharply apparent.

Cost and assembly advantages

The cost of the new cyclone tubes in molded nylon, according to Donaldson, is less than half that of the metallic tubes originally considered. The nylon helix vanes cost only about one-third as much as the die-cast vanes previously used, thanks largely to elimination of finishing costs. Other advantages of the molded nylon parts include excellent corrosion and abrasive resistance, as well as the exceptional impact properties.

It is in the assembly operations that the superiority of the plastic components over their metal counterparts becomes even more apparent. All cyclone tubes are retained to a lower metal baffle, with an air tight joint required between each tube and the baffle. In the original design for metal, it was necessary to use costly fabricating processes to obtain this fit. Thanks to the flexibility of the nylon tubes, tight fit is maintained over a temperature range of −65 to +220° F. and over forces of 10 G's. The need, therefore, for expensive sealing between baffle and tubes has been entirely eliminated.

Another assembly problem was overcome in switching from die castings to molded nylon for the helix vanes. Metal outlet tubes on which the vanes are mounted are clinched to the upper baffle plate. Next, the upper baffle, with its assembled tubes and vanes, is mounted to the lower baffle and cyclone tubes. Because of tolerance build-ups in each of the sub-assemblies, an assembly problem was created at this point when the rigid cast metal vanes were used. The greater the number of tubes involved in the assembly, the more serious the problem became. Now this difficulty is eliminated because of the flexibility of the nylon vanes. The resiliency of the material also makes it adaptable to critical force-fit assemblies without cracking or breaking.—End



Air cleaner (left), for use on heavy-duty powered equipment exposed to high dust concentrations. Center: Bottom view of cleaner, with dust cup removed, shows conical ends of nylon cyclone tubes extending through lower baffle plate. Right: Helix vane and cyclone tube sub-assemblies about to be brought together. With rigid cast metal vanes previously used, this assembly operation was difficult and costly; flexible nylon vanes conform to the tubes and the sub-assemblies mate without difficulty

PLASTICS FOR PROFITS

New king-size injection molded polyethylene container (far left) holds 300 lb. of rock salt used in regenerating automatic water softener. Galvanized steel tank of softener (center) has epoxy-based internal coating for lasting corrosion resistance

Big tanks injection molded

Water softener salt container of polyethylene weighs 100 oz., holds 31 gallons. With other plastics, assembly provides long corrosion-free life

An injection molded polyethylene brine tank measuring 27 in. deep, 21 in. in maximum diameter, and weighing approximately 100 oz. was recently adopted by Culligan, Inc., Northbrook, Ill., as a salt storage container for automatic water softeners made by this company. Believed to be one of the largest deep-draft parts ever produced by the injection process, the tank is molded by Federal Tool Corp., Chicago, Ill., on a specially modified 200-oz. HPM injection machine equipped with preplasticating cylinder.

This 31-gal. container supplements a fabricated 55-gal. polyethylene tank already in use by Culligan. Aside from the service advantages offered by both types of corrosion-resistant plastic containers over more costly metal units, the injection molded tank is significant because it indicates the size and weight of parts which can be produced economically on advanced equipment now available. Also of importance to Culligan is the fact that the molded containers, designed with a 2-deg. draft, may be nested for economical shipment and storage.

Corrosion the big problem

Because corrosion is one of the biggest problems to be overcome in water softening systems, Culligan also makes extensive use of other plastics—especially nylon, ABS resin, and epoxy—in various parts of its equipment. The new brine tank, however, is not only the largest molded part currently in use by Culligan, but also the most interesting from the production standpoint.

According to Culligan engineers, the polyethylene tank overcomes corrosion difficulties experienced with metal tanks, and is also less costly. Experiments made by the company several years ago with tanks fabricated of gal-

vanized sheet steel were abandoned as unsuccessful because of corrosion and salt "bridging" within the containers. In addition, the straight-sided construction of the metal tanks obviated nesting for economical storage and shipment. They were also considerably heavier than their polyethylene counterparts. Since the polyethylene tanks are completely immune to the corrosive action of salt and brine, Culligan engineers estimate that they should last for years. In addition, the plastic tanks, unlike metal, are not subject to denting or deforming if accidentally bumped by a hard object.

In use, the molded tank receives an initial fill of 300 lb. of rock salt used for regenerating the softener tank of an automatic water softener. Equipped with a 21-in. diameter locking cover, also injection molded of polyethylene, it can be installed as far as 30 ft. from the softener, to which it is connected by $\frac{3}{8}$-in. polyethylene tubing.

An automatic brine valve mounted in the polyethylene tank measures the amount of brine required for each regeneration cycle of the softener, shutting off when the tank is refilled. The valve is enclosed in a chamber which consists of a length of $3\frac{1}{2}$-in. diameter Kralastic tubing. At its base, the valve chamber is held in position by a shallow "well" molded in the bottom of the salt storage container. A 20-in. length of $\frac{5}{8}$-in. I. D. Kralastic tubing, curved at one end and slotted for most of its length, serves as a brine collector tube leading into the brine valve chamber near its base. Selection of ABS resin for these parts was based on its combination of mechanical strength, ease of fabrication, and immunity to corrosion.

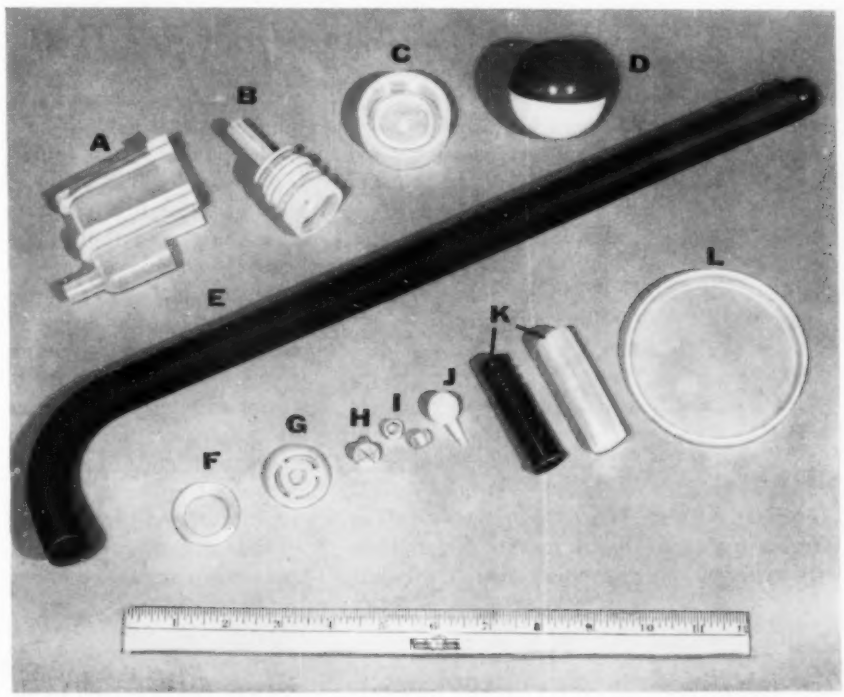
Molding the container

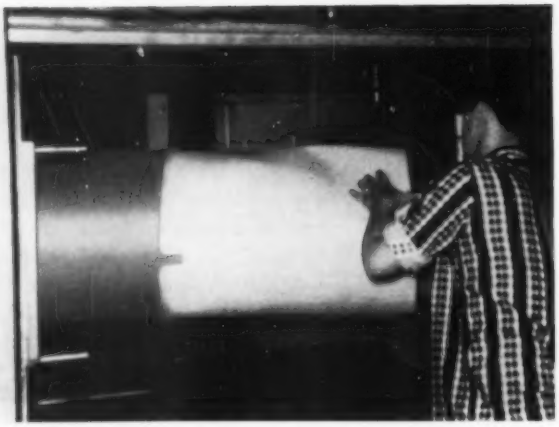
The injection machine on which the 31-gal. salt storage container is molded of Du Pont Alathon 18 material is equipped with a preplasticator and has the capacity of injecting 200 oz. of material per shot. Mold clamping force of the machine is 800 tons.

The machine has 84 in. of daylight, a 54 in. clamp stroke and a 36- by 55-in. mold mounting area. It is 33 ft. long and weighs 121,000 pounds. The single cavity die in which the container is molded weighs 10,900 pounds.

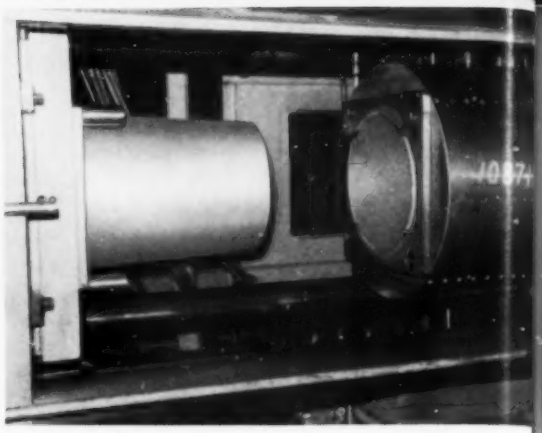
The new Culligan brine container, combining deep draft, large projection area, and a relatively thin wall section (0.090 in. on sidewalls and 0.115 on the base) posed some tough pro-

Among functional molded nylon parts used in Culligan water softening equipment are A)—overflow fitting; B)—eductor body; C)—eductor cap; F)—slip ring; G)—spider; H)—brine valve seat; and K)—manifolds used in softener tank. Air eliminator ball (J), compression sleeves (I), and brine valve cover (L) are molded of polyethylene. Other parts shown are brine valve float (D), molded of styrene, and brine collector tube (E), fabricated from ABS tubing





Extreme depth of container necessitates flexing of part as it is withdrawn from mold core. Since tank is molded of conventional polyethylene, this operation is accomplished without difficulty



Single cavity mold for container weighs 10,900 pounds. Because of thin wall sections of the part, mold halves must be held in precise alignment to prevent incomplete filling

duction problems for the molder. To mold it required a press offering exceptional length of draw and very fast injection. Molding cycle is better than 20 shots per hour.

This part is molded at low to medium temperature to produce the fast cycle and avoid shrinking and distortion. Both halves of the mold are liberally cored for water lines and cool water is circulated through the mold by an automatic temperature control unit constructed by the molder. The integral well in the bottom of the tank presented an early cooling problem which was overcome by extending water lines to this part of the mold. The container is center gated at the bottom, which is slightly concave for greater rigidity. A notch in the sidewall near the top, which accommodates a molded nylon fitting, is formed by a side cutoff.

The cover, also center gated, includes a series of four tapering radial ribs on the underside. These help to achieve fast filling of the mold and give the finished part greater flatness and rigidity. The four lugs around the edge of the cover, which interlock with the slotted rim of the tank, are produced by angle pins actuated by the knock-out action. The name Culligan, molded in relief on the top of the cover, is hot stamped in black for increased legibility. This is probably one of the largest hot stampings thus far applied to a molded polyethylene part.

Other plastics used

Relatively small in size but very important in function are some of the other plastic parts used in the water softening equipment. Several injection molded nylon components in the brine valve and control valve assemblies were specifically designed with plastics in mind. Culligan engineers point out that if made of metal, these parts would not only have been more costly but also extremely difficult to fabricate, involving several operations as compared to a molding operation producing a finished part. The plastic parts also offer immunity to corrosion.

Here is a brief review of other plastic components involved in the Culligan equipment:

Brine valve cover (polyethylene) fits over top of valve chamber, preventing salt from entering the chamber. This is a standard friction type lid similar to those used on round plastic food containers.

Float (styrene) is spherical unit molded in two halves and cemented together. Mounted on metal rod in valve chamber, it regulates the brine level in salt storage tank. This part is now being changed over to a solid float molded of expandable styrene beads.

Overflow fitting (nylon), molded with grooves to fit walls of brine tank and valve chamber, supports latter at top. It includes stepped outlet at bottom to which polyethylene drain line it clamped.

Brine valve seat (nylon) has tapered hollow top into which valve stem is threaded.

Air eliminator ball (polyethylene) makes effective use of this material's corrosion resistance and flotation properties. It prevents air from being drawn into the water softener after brine is withdrawn from the storage tank.

Eductor body (nylon) is a complicated part which could not be duplicated in metal without costly machining operations. It draws brine from the tank through the brine valve. A single size of eductor body is used for each softener tank diameter; difference in throat diameters is obtained by drilling. These parts are molded in natural color nylon and solution dyed to identify different thread sizes.

Eductor cap (nylon) retains spring which holds down nozzle or flow regulator. It incor-

porates internal threads and a knurled edge for secure finger grip.

Spider (nylon) serves as check valve seat during regeneration cycle. A rather complex part, it was specifically designed for plastics.

Slip ring (nylon) prevents rubber diaphragm in softener control assembly from rotating out of position when brass lock nut is tightened. Without it, nut would seize and twist diaphragm.

Compression sleeves (polyethylene) are used with metal fittings on the brine line ells of the control valve and on top of the brine valve assembly. Their resilience provides a leakproof joint without damaging the plastic tubing.

Manifolds (nylon), used within the softener tank, provide for passage of water in and out of tank. Slots molded in tip of upper manifold and cut in wall of lower (outlet) manifold with fine saw prevent passage of any solid material into or out of tank.

Sheath (non-toxic vinyl) for brass tube extending full interior length of softener tank protects tube against corrosion. It is expanded by air pressure for rapid insertion of tube.

Softener tank lining (epoxy) guards interior of galvanized tank against corrosion. It is sprayed into tank and cured on a highly automated U-shaped process line involving 14 separate operations yet requiring only four men. The black catalyzed Cul-Dur coating is based on Shell Chemical Corp.'s Epon resins.—End

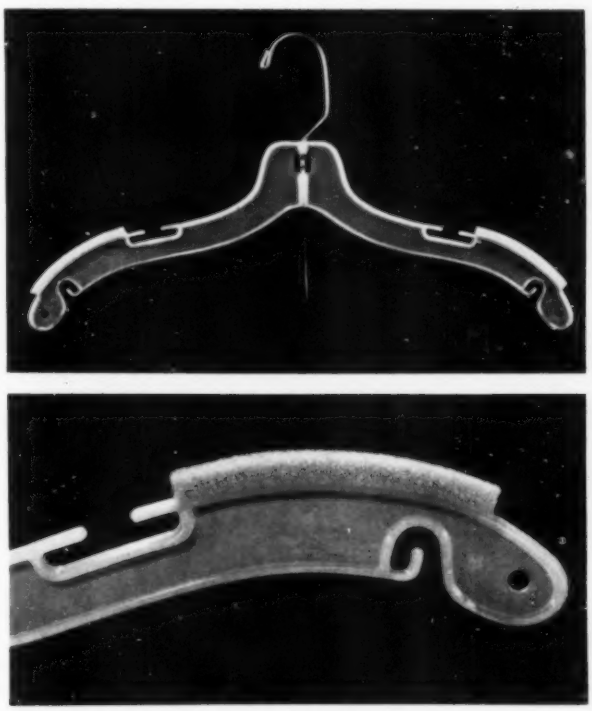
Non-skid hanger

Urethane foam pads on stock styrene hanger solve perennial problem for women

To prevent dresses and blouses from slipping off conventional hangers, women bend wire hangers into winged shapes, pin cloth strips to the garments, or use other ingenious but bothersome methods of keeping the garments in place. Whether the hanger is of wood, wire, or plastics, lightweight dresses and blouses always tend to slip off. A new hanger that will keep such garments in place, because of urethane foam pads attached to the hanger at critical points, has been developed by J. Spiegel Hanger Co., Teaneck, N. J., manufacturer of styrene hangers.

One of the company's problems was to find an adhesive that would give a strong bond between the foam pads and the styrene without crazing the latter excessively.

This was solved by Rubber & Asbestos Corp., Bloomfield, N. J., with a synthetic rubber-resin adhesive formulation, solvent-dispersed, of about 25% solids content. In production, the foam strips are cut to size and laid out on work tables. The adhesive is applied to the hangers, which are then rolled into contact with the foam strips while the adhesive is still wet. Because the adhesive is quick drying, the hangers may be packed and shipped the same day they are assembled. Ultimate bond strength is developed in about 24 hours.—End



Slipping of women's dresses is solved by styrene hanger (top) with urethane foam pads (close-up-bottom) cemented in place. Specially formulated adhesive does not unduly craze styrene

Where labor costs count

A weight of only 9 lb. as compared with 135 to more than 400 lb. for comparable units made of other materials: an installation time of only one-half hour by one man, as against several hours by two men for competitive products: a sturdy, corrosion-resistant material, easy to work with, contrasted with intractable, easily-broken materials that pit in service and are difficult to keep clean.

These comparisons highlight some of the advantages of the Monosump, a prefabricated sump-pump chamber produced of glass-reinforced polyester material by De Lucien, Inc., a subsidiary of Versal, Inc., South Bend, Ind. And they explain the growing popularity of this unit among plumbing contractors and others working with sump-pump installations.

For half a century or more, it has been customary to install sumps made of vitrified clay or pre-cast concrete. The former units weigh in at around 135 lb., while concrete sumps weigh up to 411 pounds. Even then, this does not include a bottom, which must be laboriously poured of concrete. Neither does this include a cover, which must be purchased separately and is usually fabricated from wood, cast from metal, or cut from boiler plate.

Workmen must also chisel an opening through the side of the clay or concrete sump for the inlet pipe. This is a ticklish, difficult operation; not infrequently the brittle material breaks and the entire sump must be replaced. As can well be imagined, all this costs money—money which pushes costs far above that of the Monosump for the complete installation, even though the Monosump itself is more costly than the traditional vitrified clay or concrete units.

Cost comparison

A typical quotation for installation of an 18 in. vitrified tile sump runs as follows, not including profit:

Weighing only 9 lb., Monosump and cover are easily carried into basement for installation by only one man. (Photos, De Lucien)

Sump-pump chamber units are molded of reinforced polyester material, using hand layup technique. Cover, press molded in bright yellow integral color for improved visibility, may be split or used in one piece

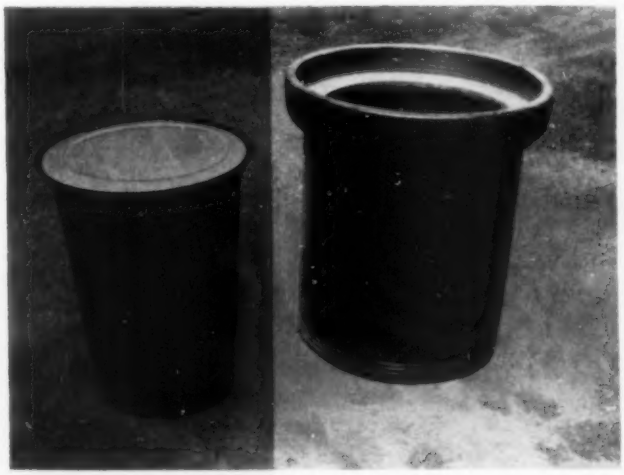
One 18-in. tile	$ 5.50
Labor for 2 men to pick up tile (1 hr. including loading & unloading)	10.00
One 18-in. cast-iron cover	5.25
Cutting, handling, cementing (1 hr.—2 men)	10.00
	$30.75

By way of contrast, plumbing contractors and builders pay approximately $13.50 for the light-weight Monosump unit, which can be easily carried into the basement by one man, who can complete the installation in half an hour. Whereas the heavy concrete or tile sumps frequently cause damage to the steps in wrestling them into the basement, this is no problem with the easily portable reinforced plastics sumps. In addition, the sumps may be ordered with installation openings pre-drilled in the side and in the cover, which is also molded of reinforced plastic. If units have to be cut on the job, this is easily accomplished with ordinary wood-working tools.

The Monosump also is equipped with a removable lint filter which catches lint from automatic washers. Because of its rounded contours and smooth inside surface, it is easily cleaned and does not promote fungus growth, as does a concrete sump pitted by detergent alkalis. The Monosump, molded in black color, is provided with a bright yellow lid for improved visibility in dark locations. It is so designed that it may be reversed if required and drilled to create a floor drain type of installation.

De Lucien produces the sump-pump chamber by the hand lay-up method; the cover is press-molded. Reinforcing material is supplied by Ferro Corp., Fiber Glass Div., Nashville, Tenn.; polyester resins by Interchemical Corp., Finishes Div., Newark, N. J., and Mol-Rez Div., American Petrochemical Corp., Minneapolis, Minn.—End

Reinforced plastics sump-pump chambers, replacing heavy concrete and vitrified clay units which require wood or metal covers, bring huge savings in shipping, handling, and installation



In addition to its weight advantage (only 9 lb. as against approximately 135 lb. for tile unit shown above), Monosumps nest (right) for compact shipping and storage; 192 of the units can be stored in a 6 by 7 by 7 ft. room

PLASTICS FOR PROFITS

EPOXIES' BIG POTENTIAL

New volume markets now opening in highway and building applications

By Elliott N. Dorman and M. M. Gruber†*

Since their introduction some 10 years ago, epoxy resins have been considered as specialty materials, high in mechanical strengths and resistance properties, but too expensive (in comparison with other basic materials) for large-scale applications. Today, volume-consuming markets are being opened which will give epoxies a sizeable potential. Biggest of these markets could be in highway and building construction.

Major resin producers are now conducting extensive programs, both in the field and in the laboratory, to evaluate epoxy materials and methods which could be adapted by builders, engineers, and architects. While other industries are feeling the effects of the recession, construction activities continue to boom. Forecasts for the next 10 years indicate a 50% increase in new construction expenditures. And by 1967, some $70 billion will be spent in this field, according to these estimates. Highway construction (considered a part of this prediction) will increase at even a steeper rate—an 88% increase by 1967, amounting to over $9 billion.[1]

High-friction surfacing compounds, in which epoxy resins are used both as binder and as adhesive, give highways non-skid safety features. They provide enduring waterproof characteristics as well

Where do epoxies fit in?

Reports from leading resin producers indicate that, in building and highway construction, epoxies could create a revolution. Extensive development in this field hinges on selling government officials on the long-range economies involved.

Used in troweling and mastic compounds, sealer and glaze coats for masonry, caulking and filling compounds, these resins are already attracting architects and builders. As protective and insulating laminates, epoxies can provide serviceable and decorative coverings for a variety of structures.

In modern office buildings where curtain-wall architecture is rapidly gaining favor, epoxies are attracting considerable attention. In this type of construction it becomes necessary to caulk, join, or bond materials of wide dissimilarity, such as metal to masonry, metal to glass, plastic to glass, plastic to metal, and many other combinations. One of the great virtues of epoxy resins, of course, is their strong adhesive characteristic which makes them the most adaptable bonding agent known.

Epoxy-reinforced fibrous glass pipe is still

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[1] Source: "The bullish outlook for building," Architectural Forum, Feb. 1958.

Extensive reconstruction job on dam at left was made unnecessary by application of epoxy compound to seal cracks and opened seams (right). Adhesive qualities of the resin insure a good bond, and many years of trouble-free service can be expected. (Photos, Permagile Corp. of America)

another area which is undergoing thorough evaluation. The most recent results of these tests by oil companies point up many advantages of such pipe—corrosion resistance, good strength, and resistance to moisture and salt water. Biggest problems seem to be in installation and designing suitable fittings. But these problems are being worked out satisfactorily according to latest reports.

One of the best potentials for epoxies lies in road and highway building and repair. Ambitious evaluation programs now underway are proving again and again the superiority of epoxy-based compounds. The tests cover several different specific uses. These include:

1) Sealing membranes. 2) High-friction surfaces. 3) Cast traffic reflecting buttons, markers, etc. 4) Adhesive films for repairs, for bonding new concrete to old concrete, reflection strips, etc.

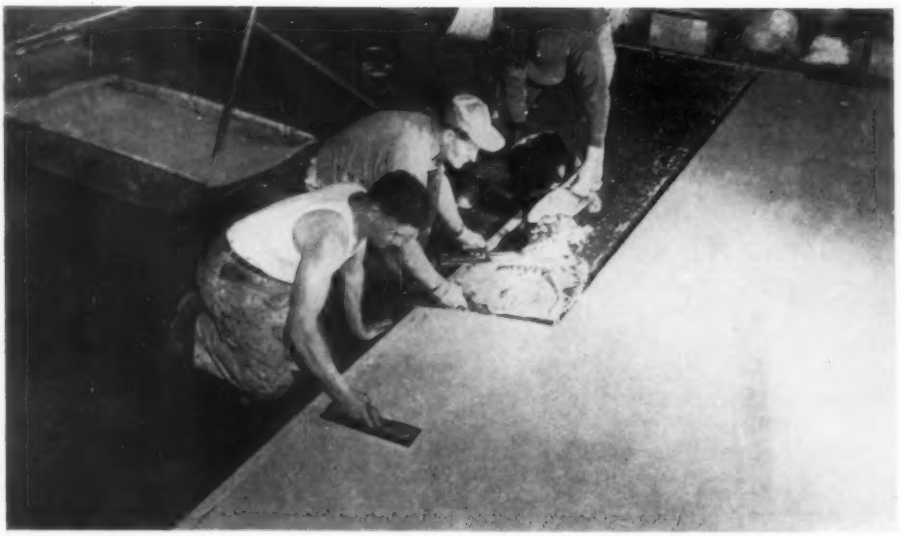
The resin systems used for these applications are rarely 100% epoxy, since these materials are many times greater in adhesive strength and chemical resistance than conventional construction materials. Instead, the resins are compounded with other resins, with fillers, pigments, high-friction materials, and aggregates to produce mixtures which fit particular applications. The wide formulating latitude of epoxies permits them to be varied to suit many different end-use conditions. All of the compounds developed thus far are two-part systems, formulated to simplify mixing. All that is required is a one-to-one ratio or just adding all the contents of one container to another.

How will these new markets affect total epoxy resins sales? All of the major resin producers think optimistically, and their answer to this question is: "Considerably!" Estimated sales of basic epoxy resins for 1957 was in the neighborhood of 28 million pounds. Any estimates for the future, of course, must be strictly on a take-your-pick range basis. Resin manufacturers say that if an aggressive selling job can convince builders and highway officials of the all-round merits of epoxies, then the picture is very bright: in five years, sales could be as high as 90 million pounds.

Road and highway applications

Highway experts consider epoxy resins to be a good bet from two very important standpoints—endurance and safety. High-friction surfacing compounds will be of considerable importance on super highways and heavily traveled bridges. In such surfaces the epoxy resin is used as a binder for the high-friction aggregate and as an adhesive to bond to the substrate. Such binders must be tough enough to withstand continuous abrasion from heavy vehicles being braked at high speeds. They also must "give" enough to bear extreme changes in weather and temperature.

The high-friction aggregate is frequently the



Flooring compound incorporating epoxy resin is applied by troweling, as with conventional concrete. Resulting tough, corrosion-resistant surface is suitable for storerooms, factories, chemical plants, dairies, etc. (Photo, Protex-A-Cote, Inc.)

expensive part of such an application and a good adhesive film is a necessity to prevent premature deterioration of the surface. In these compounds, the epoxy resin acts not only as the adhesive but also as a sealant to protect the substrate.

Audible warning strips in highway construction are an interesting possibility. Here again the epoxy compound is used with an aggregate; in this case a very coarse gravel to produce a rumbling effect when traffic passes over the surface. Typical uses for such strips are in road dividers and shoulders; approaches to intersections, curves, schools, etc.; toll booth approaches; slow and stop approaches; and similar applications.

Cast traffic reflectors

Mixed with glass beads and precast to any desired shape, epoxies provide durable, shock-resistant reflectant markings. Such compounds are easy to apply and should give far better service than present materials.

Sealing membranes

The membrane is, as the name implies, a thin coating applied over concrete structures to protect and seal the concrete as well as add strength. The inherent flexibility of epoxies helps prevent cracking—a constant problem even with reinforced concrete. This compound can be formulated so that it can be sprayed or brushed on, allowing it to cure at normal temperatures.

Adhesives and patching compounds

A wide variety of products and end-uses are covered by adhesives and patching compounds. Because of their strong adhesives characteristics, epoxies are a "natural" for bonding concrete to steel, asphalt, and even polished stone. They also have enough flexibility to allow for temperature and other changes.

One difficult job taken on by epoxies is in the repair of cracked and eroded concrete. Troweling on of new concrete has always been far from satisfactory: the new concrete doesn't stick to the old and cannot satisfactorily be "feathered" to a smooth edge. Heavily filled epoxy compounds, on the other hand, adhere well and can be troweled more smoothly. Such repairs last longer and resist corrosion much better.

When laying new concrete over old, epoxy adhesives, besides providing a good bond, also act as sealing membranes to resist the penetration of oil and water. Serviceability over widely differing conditions have been consistently proved.

Concrete and steel pipes and conduits are another large potential area for epoxy adhesives. Bonds are permanent and effective for

joint sealing all sizes of pipe. Repairs or even new pipe can be sealed to existing installations with a minimum of difficulty.

Masonry coatings

Coating materials consume about 70% of the total epoxy resin output. A portion of these epoxy coatings has replaced conventional resinous materials where the superior properties of epoxies are used to advantage. It is in new and unique areas of application, particularly in building, that epoxies may find large markets. By virtue of their special properties, these resins are extending the use of masonry and revolutionizing the architectural field.

Pigmented, cured epoxy resin systems are now being used to upgrade low-cost building materials such as cinder and concrete block. These "plain-Jane" materials have long been used on commercial and industrial buildings where attractive appearance is not important. However, weatherability, corrosion resistance, and moisture resistance have been far from satisfactory. Many methods of facing these materials have been tried: tiles, bricks, metal panels, etc. Because of excessive expense, none of these has been entirely satisfactory.

Now, cinder- and concrete-block walls can be protected with epoxy based paints. One exterior pigmented system, now in successful commercial use, is based on Ciba Araldite 502 plus a curing agent. This system is applied by spray, roller, or brush at high solids content to produce a waterproofing finish which is also decorative. In addition, the epoxy coating does not peel or flake off because of the exceptional adhesion of the resin. Efflorescence and other unsightly precipitation problems do not occur with the epoxies, as they do with many other masonry coatings.

Interior masonry surfaces may be treated the same way, or may be coated with a clear glaze epoxy finish. Various decorative effects are possible on the interior, by using multicolor or spatter finishes and applying a clear glaze epoxy coat for maximum protection.

With this combination of properties, the new epoxy systems are expanding rapidly into modern building projects, especially where low-cost materials and maintenance-free performance are important considerations.

Concrete pipe coatings

The low cost of concrete pipe for sewers and other tight-budgeted conduit installations has attracted the attention of many municipalities as well as industrial contractors. These pipes require a waterproof, corrosion resistant treatment, however, to make them practical. This has now become technically feasible through the use of epoxy-based interior and/or exterior coatings. The resistance of these coatings

Low-cost concrete pipe is spray-coated with an epoxy-based paint. Used in sewage installations, these conduits show excellent resistance to corrosive wastes, fumes, and chemicals

to sewage, chemicals, fumes, and water and hydrostatic pressure assures long life and maintenance-free service.

Surfacing compounds

Flooring and surfacing compounds based on epoxy resins have made considerable progress in the building field in recent years. These materials, based on liquid epoxies and sand or other aggregates, are compounded into a two-component system, mixed prior to use. They are usually applied by troweling a thin layer of about ¼ in. over old or new flooring—concrete, wood, or metal. These compounds are in wide use today where outstanding strength, durability, and resistance to abrasion and chemicals are important, as in warehouses, chemical plants, and swimming pools.—END

Jump seats: $5.73 less

Molded vinyl foam cushions for taxi seats eliminate many hand assembly operations

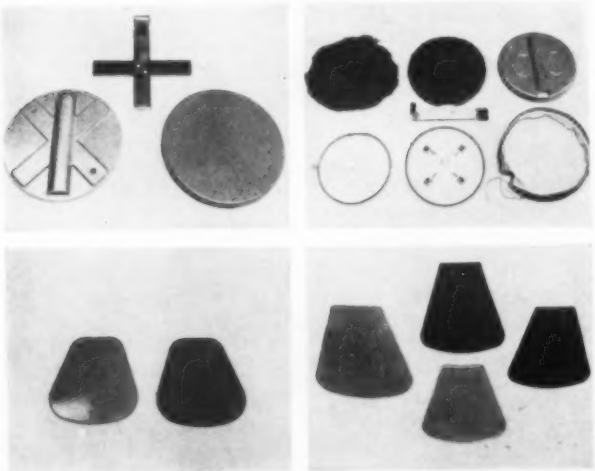
Jump-seat cushions, molded of foamed vinyl with integral skin, are thin yet comfortable, light in weight yet durable

A savings of $5.73 on each taxicab turned out by Checker Cab Mfg. Corp., Kalamazoo, Mich., has been realized by new jump-seat cushion construction based on molded vinyl foam. The saving is due largely to the elimination of a number of assembly operations.

In the new jump seat, the seat and back cushions are produced individually as single integrated units. They are molded of Vinylfoam (made of the Elastomer process) and a non-foaming vinyl plastisol, fused together to produce a resilient cushion with a "built-in" skin, which is embossed during the molding process. The resilient cushioning foam will not sag or lump; the skin resists moisture and mildew and is easy to clean.

Old-style jump-seat cushions had a molded hair pad, wadding, a rib assembly, and trim materials, all of which had to be put together by hand and laboriously sewed. The new seat cushion has three parts; the old, seven. The new back cushion has two parts; the old, four.

Vinylfoam, it is reported, can be produced in varying degrees of softness in continuous or cut-to-measure slabs as well as in molded form. It is composed of tiny interconnecting cells and hence is cool to sit on. The jump seat cushions for Checker are molded by Brown Rubber Co., Inc., Lafayette, Ind.—END



New seat parts (upper left) consist of base, spider, and molded vinyl cushion, which replace seven parts (upper right) used in old assembly. Back (lower left) has merely a frame and a cushion; old back (lower right) had four parts

New approach to drainage

Simple but revolutionary equipment works sheet vinyl into an arch and puts it underground to form a lined channel. Savings and markets are phenomenal

Nowadays, when one discusses potential markets for plastics film or sheeting in the agriculture and construction industries, it has become almost axiomatic to assume that such markets will call for *millions of miles* of material. And it is probably just as axiomatic to assume that many of these new applications will be based on cost savings that can run anywhere up to *70% or more.*

The most recent of the applications to be aimed at both these industries—a new system of subsurface drainage installation based on the use of a vinyl sheet liner—doesn't disappoint in either respect. Existing markets for subsurface drainage already offers some challenging figures:

1) It is estimated that over 19,000 miles of closed drains amounting to a construction cost of nearly $15,000,000 were installed for agricultural purposes in 1956 alone.

2) Projected needs for subsurface agricultural drains call for over 1,400,000 miles to meet current concepts of land improvement that may be economically feasible.

3) Although they have not as yet been computed, the figures on the number of miles of drains required for structures, parks, airports, and other applications are probably equally as impressive.

As to cost savings, the agricultural engineers who developed the plastic drain to replace the more expensive, cumbersome tile drains claim several significant gains:

1) Calculations place the entire cost of installation of the vinyl drain at 7 to 8¢/ft.—roughly one-third the cost of a conventional drainage system.

2) Because the trench for the plastic drain is dug only a few inches below the surface and because the vinyl sheeting can be fed off a roll, rate of installation can be as high as 1½ miles/hr.—a marked advance over conventional practices requiring trenches up to 4 ft. deep and considerable manual handling.

3) Thanks to the new technique, some of the other cost-saving features of conventional drainage systems, including the deep, wide trench, the spoil pile of dirt, and the long time required for backfill settling have all been completely eliminated.

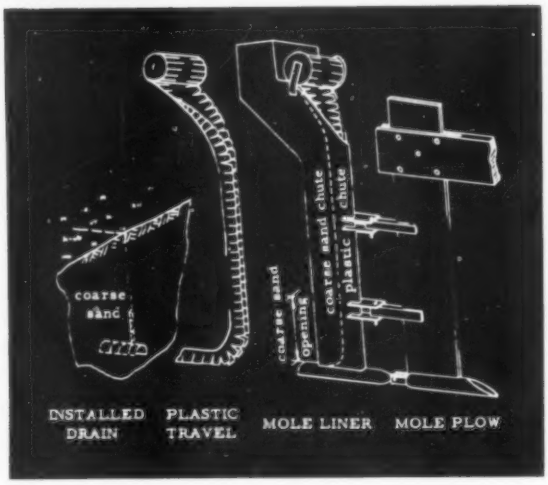
Historical background

The development of the low-cost system of drainage installation is quite a departure for both the agricultural and construction industries—particularly since little has been done in the way of modernization since drains were first made of tile back in the early 1800s. Both industries, however, have long recognized the disadvantages of the tiles: their heavy weight

Based on a paper, "Low cost subsurface drainage installation," delivered by C. D. Busch, Agricultural Engineer, Dept. of Agriculture, and T. W. Edminster, Dept. of Agriculture, Beltsville, Md., at the Seventh Annual Meeting of the Building Research Institute, April 21-23, 1958, Washington, D. C.

Arch-shaped vinyl drain lining, which acts as a support for earth above, makes it possible to economically channel drainage only a few inches below the ground

Simple equipment for channeling drain and feeding vinyl lining into place (left) can be hooked up to back of tractor. Basic equipment for laying drain liner (below) has mole plow in front to create shallow channel. Roll of vinyl sheeting is attached to coarse sand chute located behind mole plow. In later versions of equipment, sand chute was successfully eliminated. As pre-slit vinyl sheeting feeds off roll, it easily bends into a U-shape that becomes arched drain roof



plus the necessity of handling the tiles, many times at the factory and again at the site of installation—usually piece by piece. Even more frustrating was the cumbersome method of installation which required a trench 16 to 20 in. wide and 2 to 4 ft. deep to accommodate the tiles. This meant lifting up and out of the trench over 400 lb. of soil/ft. of ditch and the replacement of this same 400 lb. of soil to refill the trench after the drain had been laid. As labor costs and machine capitalization costs increase, this difficulty of installation can become a severe deterrent factor to the farmer or builder.

Some of the early attempts at eliminating the trenching problem were made with a mole drain, an earth channel only 2 to 4 in. in diameter opened in the ground. Except in a few clay and organic soils, however, these channels, with nothing inside to support them, soon began to cave in and deteriorate. The next step was an attempt to line the channels with tile or metal—neither of which was too successful.

As a result, a cooperative project was set up between Cornell University and the Soil and Water Conservation Research Div. of the U. S. Dept. of Agriculture to develop and test materials for lining mole channels.

After considerable research, attention turned to the possibility of using a semi-rigid vinyl sheeting that could be slit into ribbons of various widths, placed on rolls like paper toweling, and twisted and bent without cracking into a suitable liner within the mole channel.

The simple equipment designed to lay the plastic liner can be hooked on to the back of a tractor. A tube-like plow which forms the front half of this equipment is pulled through the soil to create the mole channel. On the back half of the equipment is mounted a 500 to 550 ft. roll of the vinyl sheeting. As the tractor moves forward, this sheeting automatically feeds off the roll, is formed into a "U," and creates an arch-shaped roof. The 15-mil sheeting is partially slit every 2 in. at right angles to its direction of travel to eliminate undue transverse stresses as it passes through the 90-degree turn when fed into the channel from a vertical position. It is necessary that this slitting be done mechanically before the sheeting is wound into a roll.

Future potential

The advantages of the lined channel are still being investigated and research is also continuing on the possibility of using other materials and more precise machines.

Whatever other improvements take place, however, the low-cost lined mole channels will doubtless find extensive use in drainage of depressions where soil conditions demand

more drains than can be justified economically, and in establishing closely spaced interception systems on hillside seeps. In water table control systems, the low cost of such an installation will permit much closer spacing of sublaterals. Its use in the distribution system of sub-surface irrigation projects seems to be a promising application.

Numerous applications can also be found in the building industry. The quick and effective draining of materials and equipment storage areas; preliminary drainage of construction sites; and draining of lawn, park, and playground areas where close spacing is essential for rapid drainage are only a few of the interesting possibilities.—END

More sap, less labor

Bucket-and-carry system of collecting sugar maple sap is replaced by miniature viaducts of polyethylene tubing

Polyethylene tubing systems for gathering sugar maple sap have been proved to be low in installation and labor costs by scores of New York State and New England farmers. In addition, set up as a series of miniature viaducts, they generally result in increased flow and better quality sap.

Outlay for the tubing, producers have found, is quickly amortized in switching from the traditional bucket-and-carry system. The tubing can be installed well ahead of the sap season and, once set up, can be operated by one man. Eliminated also are the hazards of overflowing buckets, spilled sap, and contamination. Material costs for polyethylene tubing systems are reported to be 25 to 30% lower than for open buckets.

For large stands of trees, several tubing lines may be necessary. It is recommended that from 30 to 60 taps be grouped in each collection line for greater efficiency and higher yield. When the harvest is over, the farmer still has an entire assembly of plastic tubing intact for use in the next year's sap run.

Dirt, bark, dust, debris, and rain cannot get into sap running through a closed tubing system. Nor is there any limitation on the location of spiles (taps) when tubing is used; they may be either high or low, anywhere on the tree trunk, and still allow good drainage.

The tubing system also marks the end of bucket cleaning, an unpleasant but necessary chore, with attendant saving in labor. After the season is over, all a farmer has to do is remove the spiles from the trees, pump a mild solution of chlorine and warm water through the tubing, rinse, and prepare it for summer storage.

Polyethylene tubing for these systems is made from Bakelite material by Skyline Industrial Sales, Inc., Titusville, Pa.—END

Tapping sugar maple trees for collection of sap through a closed system of polyethylene tubing increases yield, improves quality

PLASTICS FOR PROFITS

NYLON IN POWER COUPLINGS

A new type of power shaft coupling which uses injection molded nylon chain elements joined by stainless steel pins, has been developed by Morse Chain Co., Ithaca, N. Y., as an addition to its line of flexible couplings. Complete couplings, including ½-in.-pitch nylon links and soft steel sprockets, or chain elements alone, are available at a cost about 20% less than their all-steel counterparts. Properly installed, they are reported to have outlasted metal chain couplings by at least 6 to 1.

These couplings, which handle loads from fractional to 40 hp. at speeds up to 5000 r.p.m., require no lubrication and need no protective cover because of the design of the nylon links. The plastic chain element fits stock steel roller chain sprockets, and can be connected or disassembled at any link without special tools. It eliminates expensive hardened steel sprockets required by steel chain couplings.

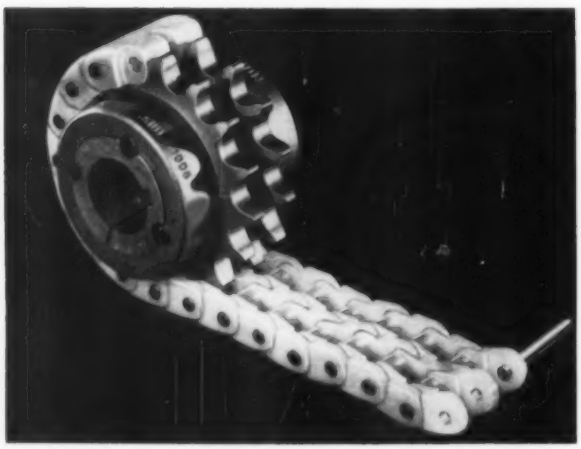
Better in many ways

The molded nylon chain coupling is corrosion resistant, runs quieter than metal couplings, and can be used at higher speeds than metal chain couplings equipped with split covers. It will not set up radio or TV interference by stray current leakage through the coupling. Unlike metal couplings, it serves as a fusible link to disconnect source of power in case of fire or drastic overheating.

Morse Chain Co. initiated research about two years ago on a coupling which would reduce complaints about failure of chain couplings due to inadequate lubrication and could be used in food packing, textile, and other installations where lubricants were not permissible. Preliminary designs ran the gamut from nylon duplicates of standard steel couplings to novel forms and combinations. All, however, would have required a safety cover to prevent accidental injury through contact with the rotating coupling, though the cover was not needed to retain grease.

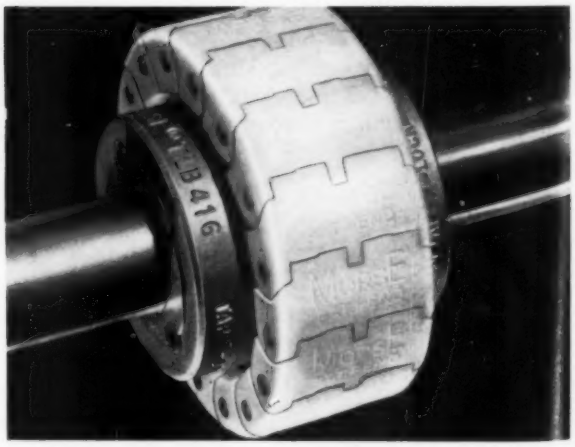
Completely new design

A completely different approach was then used. Separate pin and roller links were discarded in favor of a double-width chain made up of single links engaging both sprockets. Each link has an integrally molded cover which furnishes a smooth, virtually continuous outer surface on the assembled coupling. Links were designed to fit existing roller chain sprockets spaced the same distance apart as for standard double roller chain. Use of the single basic link permitted a chain to be assembled to any desired length without offsets. Assembly and in-



Non-corrosive molded nylon chain links, with stainless steel connecting pins, are easy to assemble on sprockets to form long-lasting power shaft coupling

Lubrication-free operation, plus smooth outer surface of assembled coupling, eliminates need for expensive cover. Drive can handle loads from fractional to 40 hp. at speeds up to 5000 r.p.m.



Chains made up of injection molded links cost less than all-steel chains, wear longer, need no lubrication

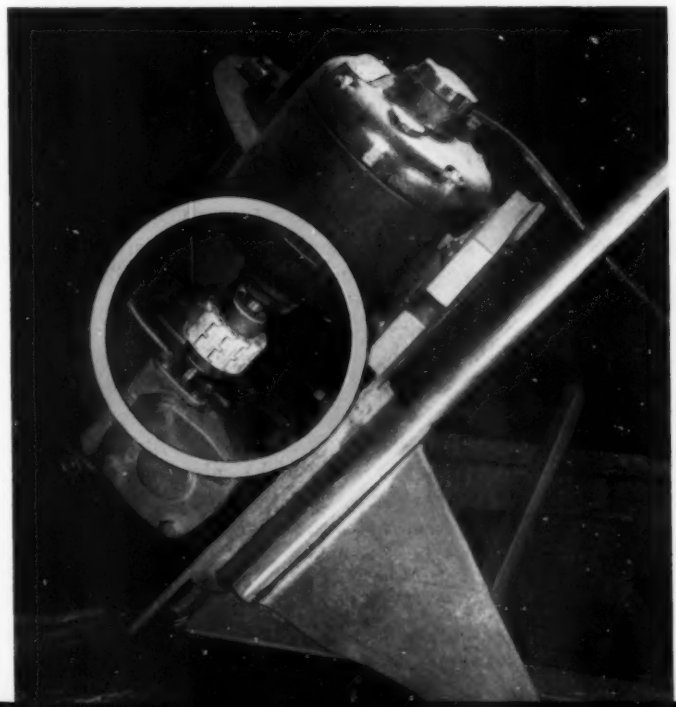
ventorying of parts were simplified and only one mold design was required.

Study of pin retention methods showed that an interference fit between pin and link combined economy, simplicity, and excellent performance. Optimum fit was determined by pressing dowel pins into holes of various sizes drilled and reamed into ⅛-in. nylon sheet stock. For preliminary test work, a single cavity mold was constructed for producing experimental links for a ½-in.-pitch chain to fit existing roller chain coupling sockets. In the production mold, slight design modifications were made to facilitate production. Molding is being done by Berea Plastics Co., Berea, Ohio, using Zytel 101 nylon.

In an initial service test, a nylon coupling was installed on a 1.3-hp. coolant pump drive in the Morse plant, operating 24 hr. daily, six days per week. Removed for examination after two months (approximately 1200 hr.) of use, it showed only minor abrasive wear. The replacement chain, installed in November, 1956, has been in continuous operation since and exhibits no signs of impending failure. In another performance test, a nylon coupling was installed on an electric motor driving an oil circulating pump. This installation posed several unfavorable conditions, including high-speed operations rendering lubrication virtually impossible and location in a pit beneath a rolling conveyor, from which dirt, sludge, chips, etc., might fall on the coupling. Whereas in this installation metal chains had required replacement on an average of two months each, and sprockets every four months, the original nylon chain is still operating after more than a year's service.

Torque capacity

Ultimate torque capacity of the nylon couplings was investigated through static torque tests at Cornell University, designed to test 12-, 16-, 20-, 24-, 28-, and 32-tooth chains to destruction. Failure of all but the 32-piece couplings was ultimately achieved, but strength of the latter resulted in a permanent spiral set in the shafts. In further tests, using heavier shafts made of hardened tool steel, the 32-tooth coupling again held but one of the shafts shattered. These tests showed that in the larger sizes, failure did not occur because of link breakage, but was in the form of stretching, which caused the chain to jump the sprockets. Thus, in the case of a major overload, the chain will fail "safe" by jumping the sprocket teeth instead of fracturing, with only minor damage to the chain.—End



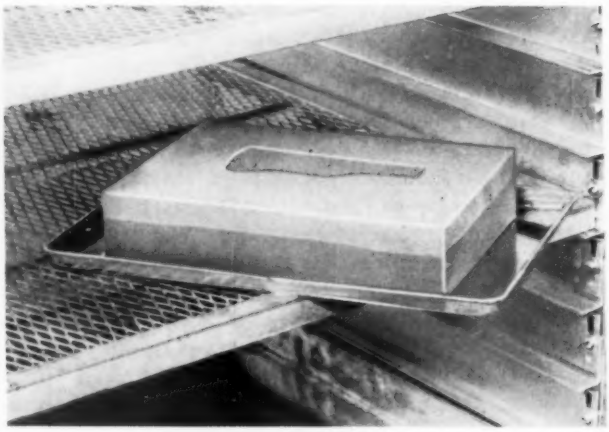
Nylon chain coupling (circle) connects motor to speed reducer in industrial power drive application. Service test reports show that nylon couplings outlast metal chain couplings by 6 to 1

PLASTICS FOR PROFITS

Dollar-saving tools

Metal-forming dies now made from epoxy-steel compound offer speed and economy

Treated metal powder, one component of two-part epoxy-steel tooling compound, is placed around die pattern. It is then packed to insure the proper degree of density



After drying, tool preform is placed in tray containing second component: liquid epoxy resin. Resin impregnates preform by capillary action during final cure

Up to 85% has been cut from time and material costs in tool-making for the metal-forming industry by an epoxy-steel compound recently announced by Minnesota Mining and Manufacturing Co., St. Paul, Minn.

The new two-component material, known as "3M" brand tooling compound 113, is designed to make punch and die sets for use in place of expensive machined metal tools for prototype or short-run draws of difficult shapes. In simpler metal-forming, tools made of the compound can be used for production runs in the thousands of pieces.

Recently, a large custom fabricator of metal parts, using the compound, reduced by 18 elapsed days (from 21 to 3) and by $621 (from $730 to $109) the time and money it would have cost to make a punch and die about 6 in. long and 2 in. wide, which included some circular and double draws up to ⅞ in. deep. About 2000 pieces were needed, drawn from 0.036-in. cold rolled steel.

Starting with the finished wood and plaster patterns, the punch and die were made, finished, machined, and drilled and tapped for mounting in only 4.8 man-hours of labor over the course of three normal working days. The amount of compound required was 36½ lb., or $73 worth; labor made up the rest of the $109 cost.

The resulting punch and die were operated at a rate of 300 pieces/hr. continuously for a 4-hr. run. Tool wear after the run was negligible, and considerable additional production is expected. The parts made met quality standards of conventional steel dies.

90% steel

The new tooling compound is more than 90% steel. This gives it the compression strength (22- to 26,000 p.s.i.), impact strength (0.4 ft. lb./in. of notch), abrasive resistance, and machineability necessary for standard press set-up and running operations. Its

thermal conductivity (0.6 B.t.u./hr./sq. ft./°F./ft.) prevents heat-up during drawing operations.

Mixing, weighing, and pot-life problems often associated with plastics tooling materials are eliminated. The 3M compound consists of a treated metal powder that can be formed into shapes having good dimensional stability or "green strength," and a thermosetting, epoxy-type liquid resin used to impregnate the molded shapes.

In use, the treated metal powder is packed around the polished and waxed pattern with a metal dowel or block to assure density. After the pattern is removed, the metal powder preform is dried in an oven at 300 to 325° F. The dried preform is then placed in a flat pan or tray containing liquid resin in the amount of approximately one-tenth the weight of the preform. The molder determines this without weighing, simply adding from time to time, if necessary, whatever resin is required to carry impregnation to the top of the preform. The pan is put in the oven for final cure at 250 to 300° F., at which temperature the proper amount of resin will completely impregnate the preform by capillary action in 1 to 2 hours. The molding will cure in 12 to 16 hr. to a hard and dense mass.

The cured tool may be drilled, tapped, or ground for flat-level mounting by ordinary machining process. Magnetic chucks may be used.

Present price range is from $12 per 4-lb. sample kit to $2 per lb. in quantities of 500 lb. or more.—END

Foamed styrene cuts missile costs

Replaces wood as fuel cell fillers in the Matador at significant savings to the producer

Making fuel cell fillers from expandable polystyrene beads has effected significant savings in cost, weight, and time in the construction of the TM 76A Matador missile produced by The Martin Co., Baltimore, Md.

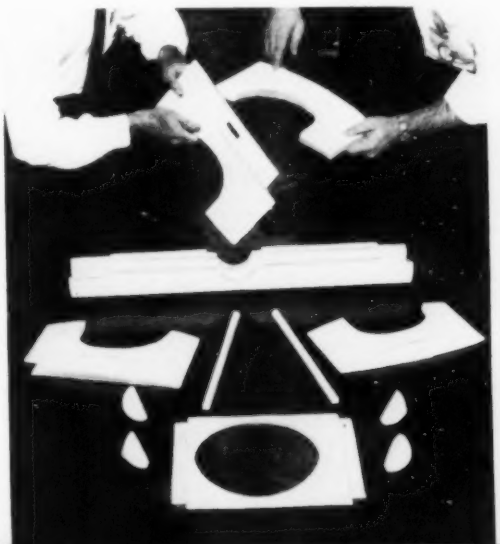
The fuel cells are made of 0.008-in. rubber film. In the cavities in which the fuel cells are located are bolts, rivets, and fittings that must be covered to prevent abrasion and rupture of the rubber tanks.

Until recently, these obstructions have been covered by small detail parts made from wood. These parts were of various configurations and required a great amount of machining and hand work. By switching to expanded polystyrene, savings in material cost were about

Based on information supplied by James A. Soutar, Research Analyst, Manufacturing Research and Development, The Martin Co.

Styrene versus wood fuel cell fillers on Matador

Material	Cost per missile	Weight per missile	Time to produce part
	$	*lb.*	*min.*
Wood	78.60	11.63	43
Expanded polystyrene	**4.80**	**3.25**	**10**



Typical fuel cell filler parts, made of expanded polystyrene for use in Matador missile, being examined by officials of The Martin Co.

93%, in weight about 70%, and in time about 75 percent. The actual figures per missile are listed in the table on p. 167.

How they are made

The fillers are produced from expandable polystyrene beads supplied by Dow. These beads are pre-expanded to a density of 5 lb./cu. ft. before being placed in the molds. The pre-expanding is done on an endless belt with an infra-red heat source. The material is then placed in aluminum restraining molds and cured by live steam in an autoclave. Holes in the molds permit steam to come in direct contact with the beads for fast, uniform expansion.—END

Data recorded on the run

Portable card-punching unit expands scope of data processing systems

A portable IBM card punching unit, especially designed for on-the-spot recording, has been made possible through proper design in plastics. The new device can be used for recording the results of physical inventories, surveys, instrument observations, calls, and similar applications, and thus extends the economy and efficiency of data processing systems to these vast areas of data collection.

The price of the instrument is only about $7.50. According to the molder, Auburn Plastics, Inc., Auburn, N. Y., "production of the unit from another material such as metal would have resulted in a prohibitive cost."

The device, called Port-A-Punch, is a plastic unit which contains 13 transverse slots into which are cemented 13 T-profile rubber strips. These form a flat, resilient cushion for the cards that are inserted for punching.

Slits between strips coincide with punching areas so that the rectangular punched-out chips can be pushed into cavities in the base.

A perforated tinted Mylar (Du Pont) templet, 0.0075 in. thick, acts as a guide for a punching stylus.

Requirements for the case were:

1) It must be possible to insert and remove cards and templet easily, yet they must not shift even slightly in use.

2) The frame must remain flat at all times; it must not warp.

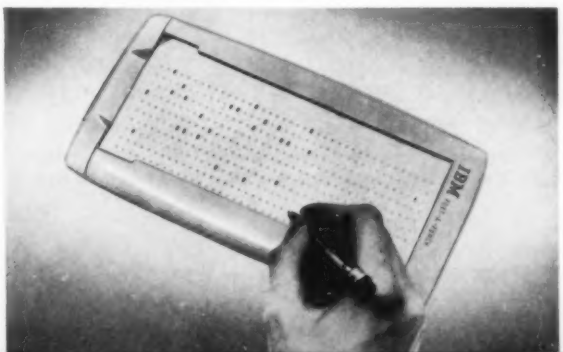
3) Because the instrument is intended for use under all kinds of conditions, it must be practically unbreakable, resist perspiration and moisture, and withstand climatic extremes, chemicals, and dust.

The material selected for this application was Dow 440-M high-impact polystyrene. It met the above requirements and in addition is pleasant to the touch.

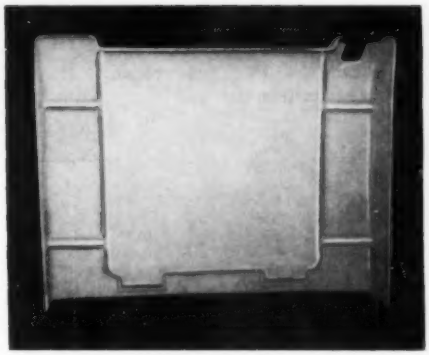
Close-tolerance molding was of particular importance for meeting several critical dimensions: length and width were held to +0.010 and —0.000 in., squareness with right edge, 0.003 in.; flat to 0.030 in.; and T slots had to be aligned within limits of the templet.

The Port-A-Punch is produced in a three-cavity family mold, including the removable end piece and the base with its intricate pattern of fins and slots. The top is cemented to the base. Tinnerman metal inserts are pressed into two drilled holes at one end of the base, while corresponding studs are inserted into the removable end piece.—END

Component parts of Port-A-Punch (left) and fully assembled unit (right)



Reinforced plastics cover for battery compartment fits directly beneath hinged seat of electric fork-lift truck. With seat raised, battery is easily accessible



Top (right above) and bottom view of the covers. Molded-in ribbing on the underside provides additional strength

PLASTICS FOR PROFITS

Why RP battery hoods?

Non-conductive properties, corrosion resistance, and 75% weight reduction lead to redesign from metal

The possibility of an improved product at effectively no increase in cost was the major factor which prompted Clark Equipment Co., Battle Creek, Mich., to specify reinforced plastics battery covers for its recently announced line of electrically powered fork trucks. The RP covers represent important weight savings over the previously used metal covers. They also offer improved properties.

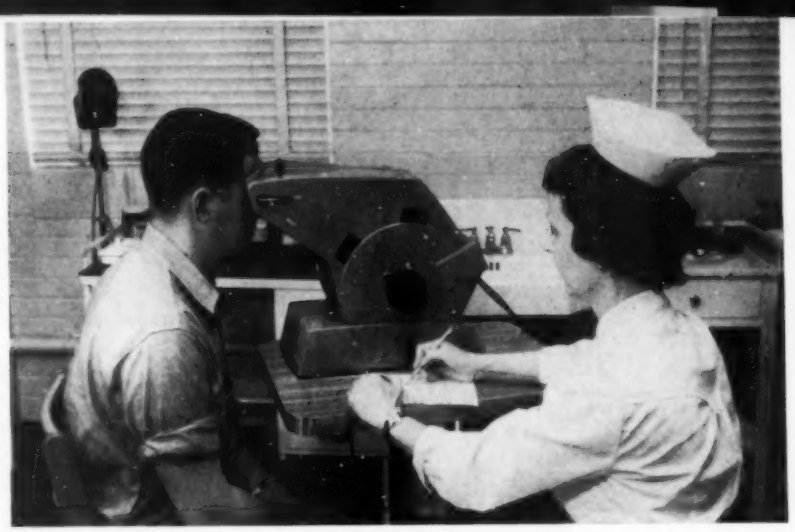
The glass-reinforced polyester hoods made their initial appearance on the 2000-lb. capacity Clarklift electric unit now in production. Models of heavier capacity are being scheduled.

The lift-off type hoods fit over the battery compartment, providing immediate access to the battery when the hinged driver's seat is swung up out of the way. According to Clark representatives, they are approximately 75% lighter for more convenient handling. Corrosion resistant, they are not subject to damage from contact with acids used in the heavy duty industrial batteries powering these trucks. Their non-conducting properties obviate the need for supplementary insulating material, eliminating the possibility of electric shock from contact with the hood. These properties give the RP covers an advantage over metal, despite the fact that the "cost differential is so slight as to be negligible," according to the Clark spokesmen.

Auto-Air Industries, Inc., Lansing, Mich., molds the Clark battery compartment covers, using a metal-filled high temperature cast epoxy mold based on Shell Epon resins. Reinforcing material for this part is a highly stitched mat from Bigelow Fiber Glass Products, Div., Bigelow-Sanford Carpet Co., New York, N. Y. The polyester resin is Polylite 8166, supplied by Reichhold Chemicals, Inc., White Plains, N. Y. The job is run on a hydraulic press at about 45 tons pressure. The mold is preheated and held at approximately 140 to 150° F.

Use of the reinforced plastics mold afforded a large saving as compared to the cost of metal molds. Construction of the mold permits several sizes of covers to be produced.—END

PLASTICS FOR PROFITS



Nearly 9 lb. of molded phenolic are used in the base and housing of this new vision testing instrument

Precision vision checking

Portable instrument for determining visual performance is lighter in weight, less expensive, better in design—through use of plastics

The design latitude, integral color, light weight, and manufacturing economies of molded plastics have all been used to advantage in a new professional type vision tester just introduced by Titmus Optical Co., Inc., Petersburg, Va.

Available for use only through licensed practitioners and, with their counsel, by industrial and commercial plants, schools, driver licensing departments, etc., this precision-built stereoscopic instrument is designed for rapid and precise measurement of visual performance. The tester shows accurately how well eyes perform but does not pinpoint the causes of low or unsatisfactory test scores; it is highly useful in correlating visual capabilities with occupational requirements and in detecting the need for more specialized optical examinations.

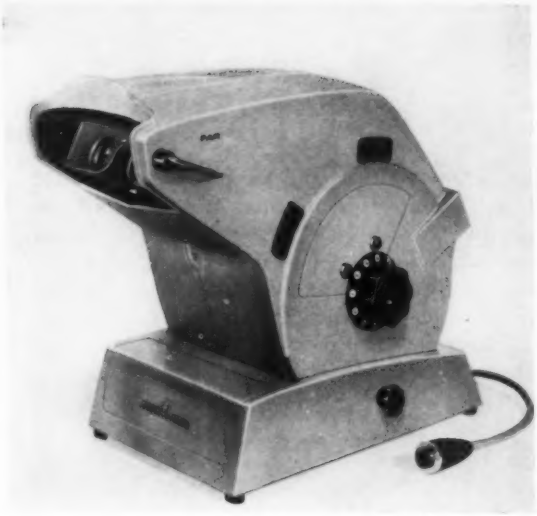
Plastics played a major role in holding the price of the instrument to a reasonable level and in reducing its total weight, giving the tester increased portability and thus enhancing its usefulness. Weighing less than 17 lb., the T O vision tester is the lightest instrument of its kind on the market. Its attractively sculptured styling is the work of Robert Podall, Chicago, Ill.

Except for certain optical and mechanical parts, the new tester is constructed entirely of plastics. Four major components of the base and housing are molded of general-purpose phenolic material. These parts, produced by Industrial Molded Products Co., Palatine, Ill., have a total weight of approximately 8½ pounds. Also produced by Industrial are the adjustable eyepiece, injection molded of impact styrene, and two rings used to anchor glass lenses into the eyepiece. Additional plastic components include phenolic adjustment knobs and levers, an internal nylon indexing wheel, and four nylon rollers on which the instrument rests in the base, permitting it to be raised or lowered to give the individual a comfortable viewing angle.

Lighter than metal

The manufacturers' decision to make these components of plastics rather than metals, which are used on competitive instruments, was based on a number of factors. Weight saving was important; it is estimated that in sand cast or die cast aluminum, the weight of the housing would have been nearly doubled. Tooling cost for die cast aluminum components might have run as much as 25% more than for the plastics parts. In addition, total production costs with the phenolic housing were substantially lower because many supplementary finishing costs were eliminated.

Whereas the plastics parts, except for deflashing, come out of the molds completely cored and ready for final assembly, with seven



Halves of housing, assembled with bolts through cored flanges, are mounted on phenolic base, where four nylon rollers facilitate adjustment to desired height. At top left is shown the adjustable styrene eyepiece

threaded brass inserts molded in, metal components would have required various drilling and tapping operations, as well as painting to obtain the desired finished color. The pre-finished surface of the phenolic components, molded in an attractive soft gray color, is not only resistant to staining, scratching, or other mishaps, but is also easily kept clean and sanitary—an important consideration on instruments coming into close contact with the face and eyes.

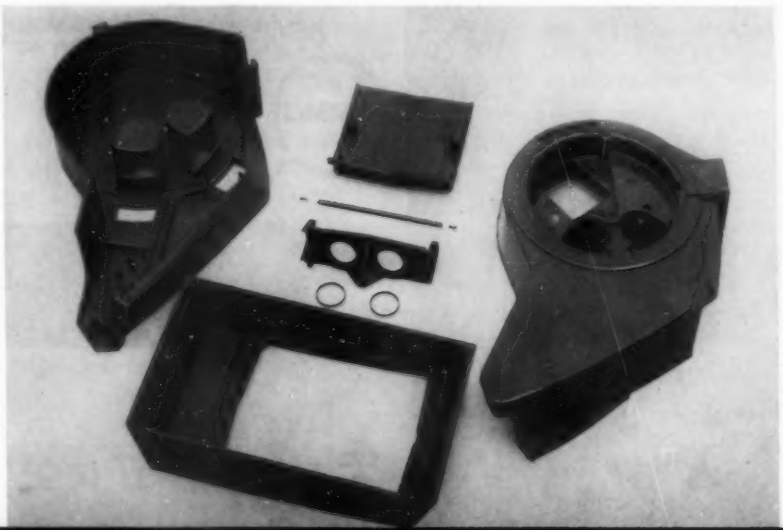
Another plus value of plastics construction is that the electrical insulating properties of the material eliminate any possibility of electric shock. Internal electrical components include four 7-w. bulbs which illuminate the glass slides used in making the eye tests and, in the case of the motorized push button control model, a small electric motor. From the assembly standpoint, the molding of integral ribs, cored bosses, and recesses, such as the four compartments which house the light bulbs, speed and simplify production.

Principal internal components of the T/O tester include a pivoted eyepiece which is manually shifted from "Far" to "Near," a rotatable drum on which stereoscopic test slides are mounted, a front-surfaced mirror used in conjunction with the Far tests, and the four light chambers. On the electrically operated model, the drum is moved through the testing stages at the touch of a button, positioning each slide in proper sequence. On manually controlled models, this is accomplished by rotating an indexed molded phenolic dial. Another knob controls the height adjustment, permitting a 7-in. movement of the instrument on the nylon bearings located within the base.

Molding details

Phenolic components are compression molded of Bakelite 2010 Type 75 gray general-purpose material. The mating halves of the housing are produced in separate single-cavity molds run on a 300-ton compression press, using electronically heated preforms. Other principal phenolic parts are the base, molded on a 200-ton compression press, and the cover, produced on a 150-ton unit. Side cores in the latter mold produce two openings on the bottom of the part through which a metal shaft is inserted in the final assembly, hinging the cover in position. This door affords access to the inside of the instrument for insertion and removal of the slides.

Inasmuch as a high degree of dimensional accuracy must be maintained so that the two



Four major phenolic components include left and right halves of housing, base (foreground), and hinged access door (top center) for back of housing. Impact styrene parts in center of photo are eyepiece and lens mounting rings

PLASTICS FOR PROFITS

halves of the housing will mate precisely at all points, metal cooling fixtures and templates are used by the molder. The molding cycle on the two case halves runs approximately 25 shots. The adjustable eyepiece which mounts at the viewing end of the instrument is produced on an 8-oz. injection machine, using Dow Styron 475 black high-impact polystyrene.

The four nylon rollers on which the instrument housing rests and the nylon index wheel which controls the detention of the slide drum in its successive viewing positions are injection molded by United Fabricators & Electronics, Inc., Stillwater, Minn. The three black general-purpose phenolic control knobs which mount on the right side of the vision tester are supplied by Harry Davies Molding Co., Chicago, Ill.—END

Reinforced control handle

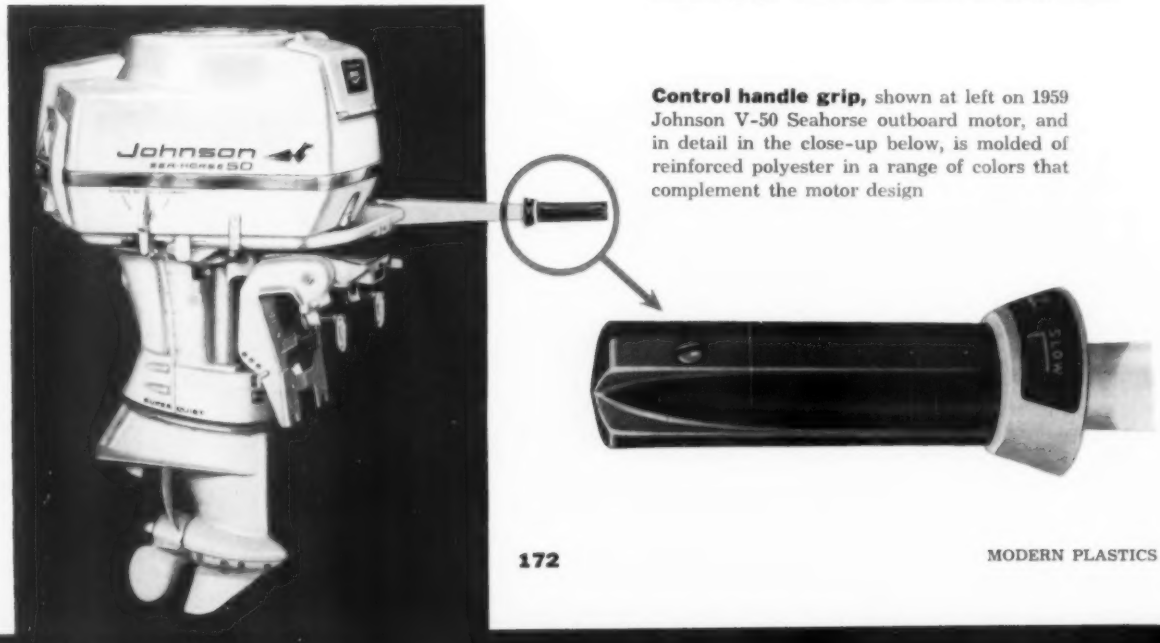
Corrosion resistance, strength, and beauty combined in outboard motor component

Even in such a utilitarian product as outboard motors, appearance—both in the showroom and after extended use—is being recognized by manufacturers as an important competitive factor in an expanding market.

As a result of such recognition, Johnson Motors is using an increasing number of plastics parts in its 1959 line to gain not only beauty in appearance and design but also resistance to corrosion and greater strength. Important among these is the control handle grip, transfer molded of Thermaflow reinforced polyester compound produced by Atlas Powder Co. Taking advantage of the color range in which the material is available, the handles are being molded in white, black, gray, and blue-green, making it easy to have the appearance of the handle complement the design of the motor.

The molded reinforced polyester handles provide the user with a comfortable grip for steering and control of engine speed. They replace rubber which leaves a sticky coating on the operator's hands and which often becomes unsightly after exposure to water, oil, and gasoline. In addition, the plastic is so strong—in tests, handles have been repeatedly slammed against a concrete wall with no sign of failure—that set screws can be used to insure positive locking to the shaft on which the grip is mounted.

Atlas states that about 75% of all outboard handle grips will be so made in 1959.—END



Control handle grip, shown at left on 1959 Johnson V-50 Seahorse outboard motor, and in detail in the close-up below, is molded of reinforced polyester in a range of colors that complement the motor design

Workmen in background (left) put finishing touches to inside of air-supported plant. Inside ribs (one shown at top) are for suspending light fixtures, not for structural support. Below is outside view of building, which is 340 ft. long and 30 ft. wide

Air-supported factory

For the first time in history, a plastics company fabricates its own building out of its own product

More than obvious publicity was involved when G. T. Schjeldahl Co., Northfield, Minn., maker of stratospheric balloons, air-supported structures, and plastics bag-making machinery decided to house part of its manufacturing facilities in an air-supported factory. The decision was based on cold economic considerations as well.

The new plant, fabricated of Scotchpak nylon-fiber-reinforced heat-sealable polyester film (Minnesota Mining & Mfg. Co.), is 340 ft. long and 30 ft. wide. It houses a work force of 30 employees. The ends are of solid construction. Air pressure to keep the building fully inflated is only 1 p.s.i. higher than prevailing atmospheric pressure. Air-blower equipment, rest rooms, and heating units are located in a separate structure inside the building.

While no aging tests have yet been completed, the known properties of the film presage long life. When replacement is necessary, it can be done "in less than 2 hr. and at a cost comparable to that of a paint job for a conventional structure," according to G. T. Schjeldahl, president of the firm.

Of particular interest are the economics resulting from heat savings.

The translucent skin permits solar heating of the plant in the winter. As much as 2 million B.t.u./hr. are admitted on bright sunlit days. This compares with 90 to 120,000 for an average home furnace. On cloudy days, conventional heating equipment is used. During the summer, a system of sun shades and air conditioners keeps the building cool.

The Schjeldahl firm expects that the plastic skin of the building will pay for itself in heat savings alone over a period of five years.—END

PLASTICS FOR PROFITS

Without leaving car, patrons can order meals through microphone at drive-in restaurants. Combination speaker-microphone uses several plastics materials

Electrical car-hop

Plastics parts in combination telephone and music system for drive-in restaurants make for lower costs

A cost advantage of approximately 2½ to 1, plus permanent, integral color, persuaded a Midwest manufacturer to specify plastics rather than metal for important components of a new serving station unit designed for drive-in type restaurants.

Motiograph, Inc., Chicago, Ill., a pioneer supplier of equipment for the movie industry and related fields, is turning increasingly to plastics to keep the cost of its products on a competitive basis without sacrificing quality, appearance, or performance. An excellent case in point is Motiograph's new Servus-Fone installation, a combination telephone and music system for drive-in restaurants, which enables the patron to place his order through a microphone without leaving the car.

Each unit serves two cars; it has two lighted menus, two microphones, and two tray rests. A battery of these stations enables the drive-in restaurant to speed up service while reducing car-hops' trips from two or three to one visit per car. Result: more efficient use of parking facilities, fewer car-hops, faster turnover of patrons—and bigger profits!

For the latest version of its Servus-Fone station, Motiograph required a multi-purpose base unit for the menu housing assembly, which is constructed of cold rolled steel and aluminum. This base unit, made up of two identical parts used in reversed position, also incorporates integral cradles for the two-way microphones. Motiograph carefully evaluated plastics against aluminum sandcastings for these parts—with plastics emerging as the winner by a comfortable margin.

Even though the mold cost for production of the plastic parts was estimated at more than

six times that for a comparable sand casting, comparative cost of finished parts, based on a run of 1000 or more units, revealed an entirely different story. Including drilling, tapping, priming, and painting, cast aluminum units would have pushed the cost of the finished assembly to approximately $10, compared to under $4 for the molded plastic parts. In addition to the cost advantage, Ray Brija, Motiograph engineer, points out that the plastic parts have more consistent physical properties and more attractive, permanent color.

Base unit moldings

The base unit moldings are produced by Imperial Molded Products Corp., Chicago, Ill., using Fiberite X-1303 phenolic-nylon alloy. This recently developed material is synergistic in nature; that is, it is reported to have the combined properties of phenolic and nylon, plus enhancing features which are said to be the result of the alloying technique used.

Characteristics of the material include good impact resistance combined with low bulk factor (3 to 3.5) and the ability to be tabletted in the usual preforming equipment. The material in molded form also exhibits good mechanical strength, low water absorption, resiliency, and excellent electrical properties. Imperial preforms and preheats the material, molding the parts on a 200-ton compression press in a single-cavity mold. Finishing includes deflashing and drilling several assembly holes in the end moldings.

Also used in the new Servus-Fone installations is a new type of in-car unit, injection molded of Forticel cellulose propionate by Advance Molded Plastics Corp., Chicago, Ill. The plastic microphone supplements and is gradually supplanting an earlier die cast aluminum unit which is approximately 10% more costly to produce and is heavier. Whereas the metal microphone requires special plating for corrosion protection, plus two coats of enamel, the plastic version has its own integral color and requires no surface finishing.

The two components comprising the microphone housing are the front section, with a louvered speaker grille, and the back half, designed with an L-shaped projection so it can be hung over the top of an opened car window. Internal blind cores in the front section pro-

Front and rear views of phenolic-nylon alloy base moldings (left) show how these multi-purpose units incorporate mike cradle, frame for instruction panel, and push button. Molded propionate speaker-microphone (right), made in front and back sections, combines color, light weight, durability, and ease of assembly

vide for rapid mounting of the electrical components with self-tapping screws.

Among other plastics components used is a red acrylic light housing, injection molded by Imperial, with a push-button controlled bulb which signals when patrons are finished with their trays. Menus are laminated between two sheets of 0.010 Bakelite rigid vinyl sheeting by J. B. Carroll Co., Chicago, Ill., for permanent weather resistance.

Translucent acrylic light shields, two of which are mounted at the top of each service station to illuminate both sides of the menu, are thermoformed of ⅛ in. Polycast stock by Cicero Plastic Products, Cicero, Ill. Midwest Screen Arts, Inc., Chicago, Ill., silk screens an instruction panel on the reverse face of 0.125-in. clear transparent acrylic stock, which is supplied by the Polycast Corp., Stamford, Conn.—END

Milk dispensed by the cup

Vending machine sales go up 300 to 400% when cartons are replaced by cup service through disposable polyethylene tube

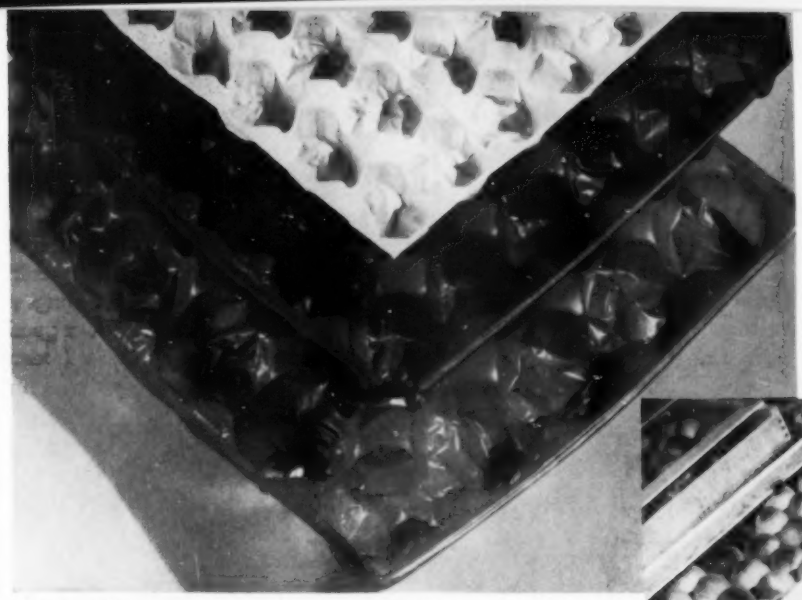
No valves or pumps; just a disposable polyethylene bag. That is the key to the success of the Cup-O-Matic bulk milk vending mechanism which dispenses the fluid by the cup. Route salesmen report 300 to 400% increases in sales when cups replace cartons.

"We feel it is this polyethylene bag that has made bulk milk vending practical," says D. W. Brous, president of Food Engineering Corp., Manchester, N. H. "Stainless steel valves, or anything which must be washed at the dairy and kept sterile in transit, were expensive and delayed mass adoption of bulk milk vending."

The one-trip bags, fabricated of Bakelite polyethylene by heat sealing, are sterilized electronically at the dairy plant, slipped onto the bottom outlet of the can, and then folded up so that nothing can contaminate the inner surfaces with which the milk will come in contact. At the vending machine, the bag is simply unfolded and slipped between top and bottom clamp mechanisms that automatically open and shut in proper sequence when a coin is inserted. Precisely measured quantities of milk are released to a paper cup placed below the bottom outlet of the polyethylene bag. When the milk can is empty, the bag is removed and discarded.

The whole system is clean, neat, and sanitary. Customers like it because milk comes to them icy cold, and they are never confronted with leaky containers. Route men like it because they can carry and load two 20-qt. cans into the dispenser with less effort than required with 160 half-pint cartons or bottles.—END

Milk vending machine (left) delivers accurately measured quantities of milk through sanitary polyethylene bags (right), controlled by simple clamp mechanisms at each end



Vacuum-formed rigid vinyl trays, produced on a continuous basis, provide a moisture-proof, contour molded packing medium for shipment of fresh fruit

Peaches, individually nested in pockets of vinyl trays (arrow), are part of shipment flown from California to New York. Trays prevent bruising or other damage to fruit

Revolutionary fruit pack

Competing in price with paper, vacuum formed rigid vinyl film trays give fruit better protection and save labor

Rigid vinyl film, vacuum formed into trays with individual pockets, is replacing fluted paper cups or plain paper wrapping in the fruit packing industry. The advantages claimed for the new packaging material are better protection of fruit in transport and significant labor cost savings—at prices that are competitive with paper.

The trays, designated Panta-Pak, are made by The Pantasote Co., New York, N. Y., of 5-gage calendered film. They come in 30 different patterns to fit various fruits and in two sizes—16⅛ by 13½ and 16⅛ by 11½ inches. Pantasote vacuum forms the trays in a continuous process under an agreement with Campagnia Italiana Nest-Pack, Bologna, Italy.

Since the trays provide pockets in which each fruit can nest separately, bruising is practically eliminated—an important consideration in packing peaches, nectarines, plums, persimmons, and fresh figs. In a recent test, the U. S. Dept. of Agriculture found that of fruit shipped in Panta-Pak trays, less than ½ of 1% bruised, a percentage that falls within its top rating.

Cost of vinyl trays averages no more than that of fluted paper cups, their main competition. The large trays cost 5½¢ each to the grower, while the smaller trays are 5⅛ cents. The trays hold anywhere from 15 to 56 fruit, depending on size.

The trays save labor because they permit packers to use both hands to move fruit; the

worker has to use one hand to hold either a fluted cup or wrapping paper. Also, less skilled labor can be employed, because the conventional packing method demands workers who can "eye size" fruit moving on a conveyor belt. A Panta-Pak tray does the sizing for the worker, since a fruit which is over-size will not fit the tray and is not packed. Several large California packers have offered to pack fruit in vinyl trays for 1¢ per layer less than paper packing charges.

Another advantage of the vinyl trays is that they permit hydrocooling, in which a cold water bath cools fruit to keep it fresh longer. This method has been used on unwrapped fruit in bushel baskets, but it has not been entirely satisfactory with fruit packed in paper.—END

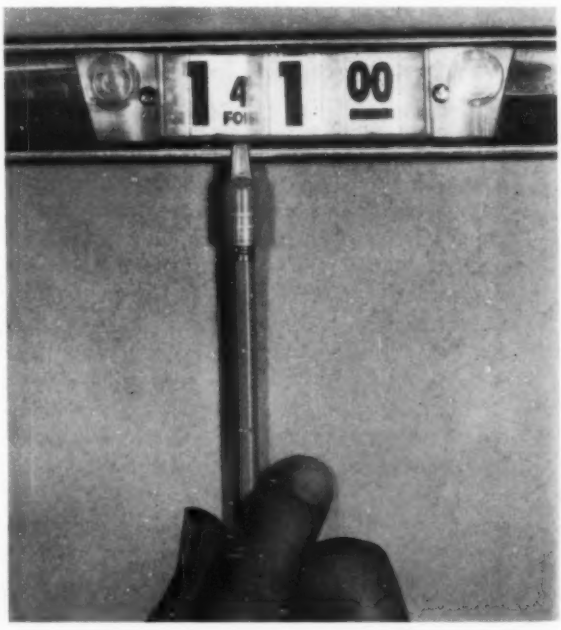
The price is always right

Continuously changeable "price ticket," engineered in styrene, has potential in tens of million units because of labor savings

Large savings in the cost of changing prices on merchandise displays in supermarkets, chain stores, and other retail outlets are offered by the Jet Pricer, a self-contained pricing unit made up of molded styrene parts and paper tapes. Manufactured by Consumer Activation Products, Inc., New York, N. Y., the face of the Jet Pricer is molded with flat and ribbed areas to give the effect of three windows, behind each of which is a continuous tape printed with 23 numbers and symbols and mounted on two spindles. Both ends of each spindle are slotted. Supplied with each unit is a key, shaped like a screw driver, which fits over the end of a pencil. By engaging the key with the appropriate slot, any price desired can be dialed. As a result, the possible combinations number in the thousands.

Potential savings

An example of the potential savings in pricing costs by one supermarket is given by the manufacturer of the Jet Pricer as follows: The market, with 7000 prices to handle, places its cost for price changing and maintenance at $3100 a year. It is claimed that this can be reduced by two thirds—by over $2000 a year—with the plastics pricing units. Since the cost of the price dialers—23¢ each in large lots—would be only $1610 for this one retail outlet, the investment would be absorbed in less than one year.



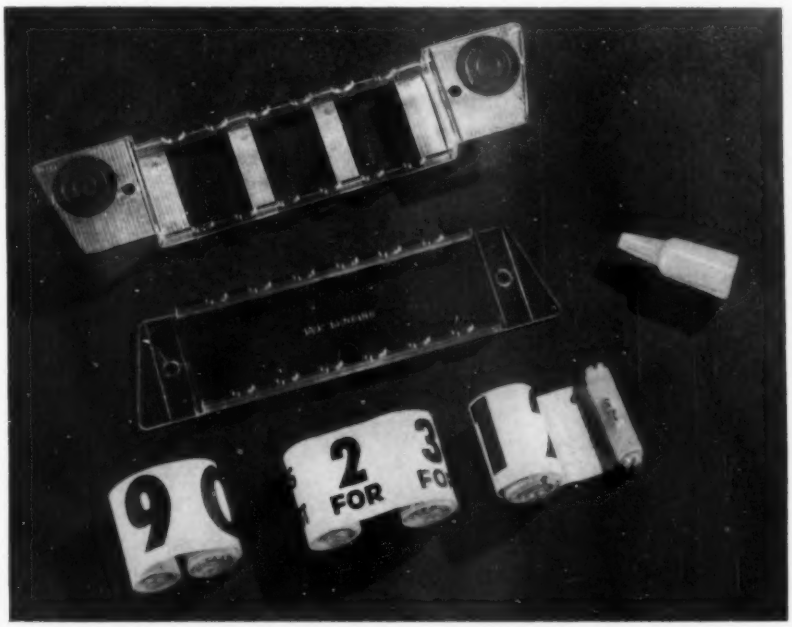
Turn of key on standard pencil changes numerals in self-contained pricing unit. Both key and case are molded of styrene

In supermarket, the units offer important savings in cost of labor for price changing and maintenance

The two parts of the Jet Pricer housing, 4⅞ in. long by 1 in. wide by ½ in. deep, are molded of Monsanto styrene. A special formulation is used which is stated to be unusually resistant to discoloration, food staining, and scratching. The spindles, to which the paper tapes are attached by stapling, are molded of high-impact styrene, as is also the price-changing key.

The pricer dialer is available with a variety of mountings so that it can be attached to shelves, clipped to glass partitions (for use in variety chains), stuck into meat and vegetables, or hooked onto bottle necks.

Sales potential of the Jet Pricer is well up in the tens of millions. Its initial reception was described as being excellent, and the manufacturer reports that over two million units were sold in the first two weeks after its introduction.—END



Breakdown of unit shows front plate with windows (at top), back plate, and three paper tapes attached to impact styrene spindles by stapling. Key is at right

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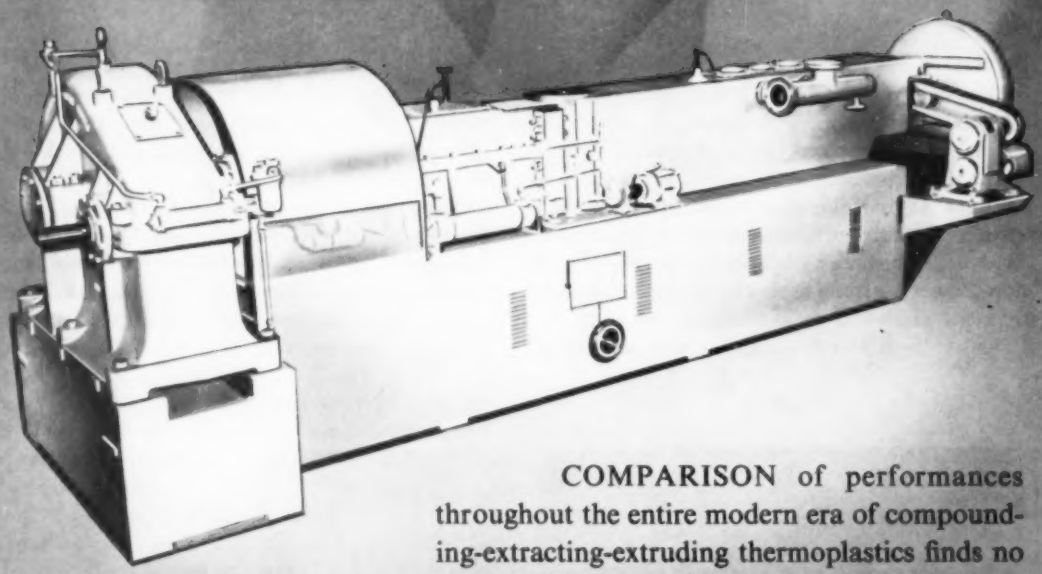

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Economics of unscrewing molds

Cost can be greatly reduced by standardizing mold-base designs to accept interchangeable parts

By Islyn Thomas and Ernest J. Csaszar†

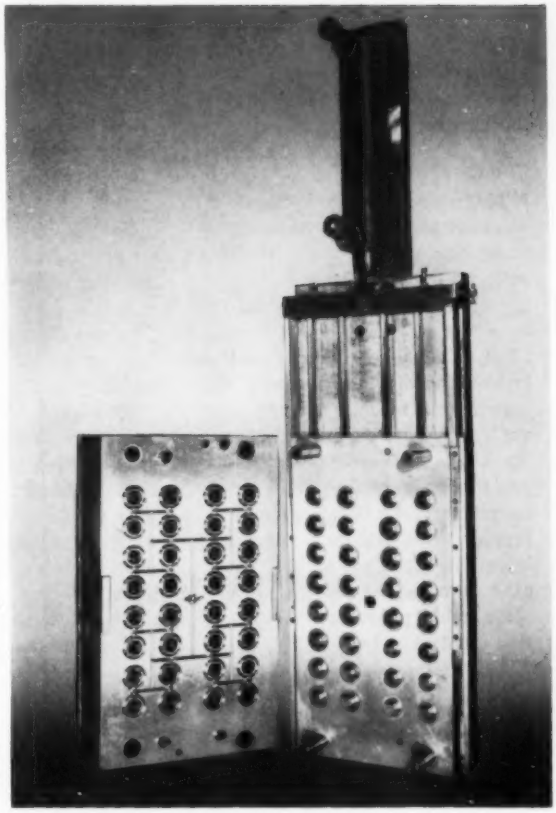


Fig. 1: Thirty-two cavity mold for thermoplastic closures automatically unscrews and degates pieces. (Photo, Armstrong Cork Co.)

Thermoplastic closures are today faced with keener competition from other materials than ever before. To meet this competition it has become necessary to design and construct automatic unscrewing molds, which are costly because of their complexity. As the demand for such molds has grown, an obvious method of reducing cost has become practical: standardization of parts.

Whenever high production quantities are spoken of—and closures often run into the millions—words like "automation," "multi-cavity molds," and "interchangeability" enter the conversation. With the general run of molded products, unfortunately, the mold requirements are not sufficiently the same in size, action, or specific design to allow the mold maker to stock standard parts. Closures, however, in spite of many differences in outside design, have certain features in common. First, there is usually a right-hand, internal thread. Second, the majority of sizes fall within a rather small range. Third, most of them have basically the same shape—the truncated cone and minor variations thereon. Fourth, the operations of molding, unscrewing, and ejection are common and similarly executed in all.

With these important common factors, it is practical to standardize and stock many of the basic mold elements for closure molds. In fact, the entire mold base for a range of closure sizes can be built in advance, complete with unscrewing, degating, and ejection mechanisms. Such a base can be used for many different caps, so its initial cost is spread over all the separate jobs, thus reducing substantially the basic tooling cost per job. Further, once the standard mold base is on hand, the preparation of a new set of interchangeable cavities, forces, and stripper bushings can be accomplished in a relatively short time. This helps the molder

*Reg. U. S. Pat. Off.
†See p. 182.

to be able to make the early delivery that is so often a primary factor in getting the order.

Figure 1, p. 181, is a photograph of an automatically unscrewing and degating mold base, complete with hydraulically operated unscrewing mechanism. This particular base was designed to run in a 6-oz. Fellows automatic. It is easy to remove the cavities, forces, and bushings, and to readjust the unscrewing mechanism to accommodate a new set of elements for another closure within the size range of this base.

Thomas

Csaszar

The authors—Islyn Thomas is president of the Newark Die Co., Newark, N. J., a past president of the Society of the Plastics Engineers, Inc., and a Director of the Society of the Plastics Industry, Inc. He is the author of numerous articles on design and production of molds as well as the book, "Injection molding of plastics," and he is regarded as a leading authority on these subjects. Ernest J. Csaszar, who is sales manager of the same company, is also very active in S.P.E. and S.P.I. After receiving his B.S. in M.E. from Newark College of Engineering in 1940, he was chief engineer of Universal Plastics Corp. until 1945, spent a year at the Naval Ordnance Laboratory, then was Vice-President of Sales and Engineering of Eagle Tool & Machine Co., until it became part of his present company.

The machine itself

There are certain functions so common to all unscrewing molds that they can be built into the molding machine itself, thus saving the cost of duplicating the required mechanism in each mold. First, since hydraulic activation is excellent for the purpose, the unscrewing mechanism can conveniently draw its power from the machine's hydraulic system. The press manufacturer will be happy to suggest the best method of tapping into the system. Some injection machine makers even offer power-take-off units complete with pressure-control and flow-control valves.

Second, the machine should be equipped with a controller for the opening stroke so that the movement of the platen can be slowed down or stopped to accommodate the unscrewing portion of the molding cycle.

Third, it is sometimes necessary to have an independent motion to accomplish knocking out of the runner system. Auxiliary cylinders on the stationary half of the machine will often serve this purpose, and they are less expensive than building a mechanism into the mold to do the same job.

The over-all molding cycle depends on a number of factors, such as the type and size of the machine, the shape and wall thickness of the closures being molded, and the molding compound being used. Cycles on the order of 12 to 18 sec. are typical under ideal conditions.

The mold

Figure 2, left, is a section through one of the cavities of an automatic unscrewing mold, showing the assembly of interchangeable units. The runner system in this standard mold base was designed for caps that are

Fig. 2: Sketch showing the construction of closure cavity for outside-center gating

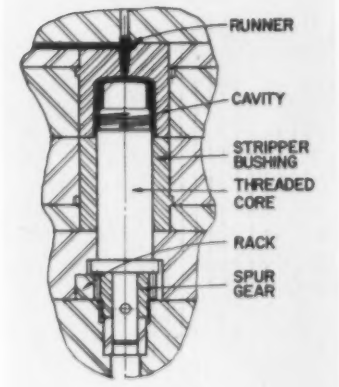


Fig. 3: Typical closures made in outside-center gated automatic unscrewing mold. (Photo, Armstrong Cork Co.)

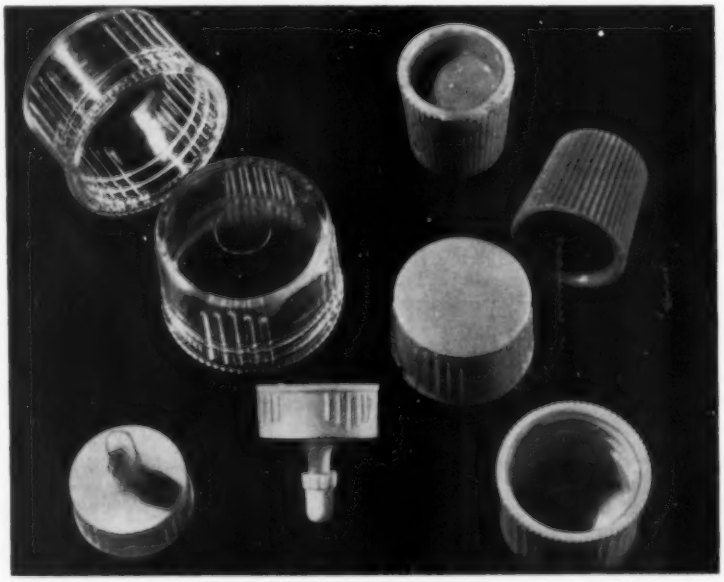


Fig. 6: Array of parts for 32-cavity automatic closure mold. (Photo, Armstrong Cork and Mack Molding)

outside-center gated. Four pairs of such caps are shown in Fig. 3.

For caps that cannot be outside-center gated, the sub-gating system shown in Fig. 4, below, may be used, or the piece may be inside-center gated as in Fig. 5, below. Note that in Fig. 5, only the outside sleeve of the force turns to unscrew the caps. In a fourth type, the unscrewing action is accomplished by rotating the cavities rather than the forces.

The three types of construction shown in Figs. 2, 4, and 5 establish standard mold frames, each of which can be used with a wide variety of interchangeable cavities and forces. As an example of the savings that this interchangeability makes possible, consider the 32-cavity mold of Fig. 1. The complete mold cost about $13,000; an additional set of components for a new closure would run about $4000, and could be delivered sooner than could an entirely new, non-standard mold. Because these complex molds have many parts that must work together reliably over long periods of uninterrupted operation (see Fig. 6, above), close control of dimensions is essential.

Hob if you can

An important item in the cost of a multi-cavity mold is the cost of shaping and finishing the cavities. It has long been recognized that where the cavities are hobbable, hobbing is usually the most economical method of making more than a few cavities. This is so because, once the hob is made, hobbing is very fast; also, a hobbed cavity has a surface finish as good as that of the hob and seldom requires any finishing. It is not so well known, however, that advances in hobbing techniques have recently made possible the hobbing of cavities with slight undercuts. The method is particularly applicable to closure cavities, where the amount of undercut desired to give an intaglio design on the side surface of a screw cap is uniformly small. Such a cap, together with the hob used to form the steel cavity in which it was molded, is shown in Fig. 7, p. 186.

The hobbing of these cavities, though simple in principle, requires a great deal of experience and very careful selection of steels for the hob and for the cavities. To hob cavities with designs on the sides, one must use tapered and split hobbing rings like those sketched in Fig. 8, p. 186. In Fig. 9, p. 186, a similar setup is shown as it is being removed after hobbing.

To properly bring out such a design it may be necessary to repeat the hobbing operation several times, annealing the blank between successive strokes. The degree of true and apparent undercut that can be hobbed depends on the amount of side taper that can be tolerated on the part. The greater the angle, the deeper the undercut possible. The design itself is a factor, and its features must sometimes be altered to facilitate the flow of metal and the subsequent withdrawal of the hob

(To page 186)

Fig. 4: Sketch showing details of closure cavity with submarine gating near edge of cap

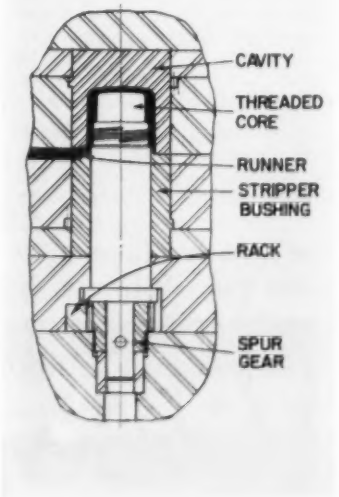
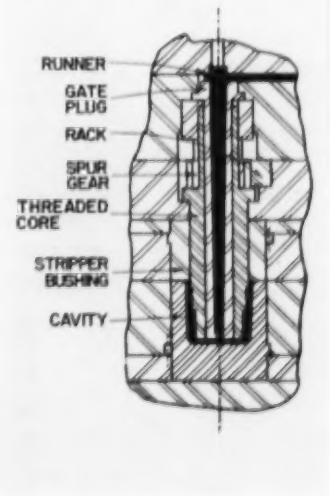
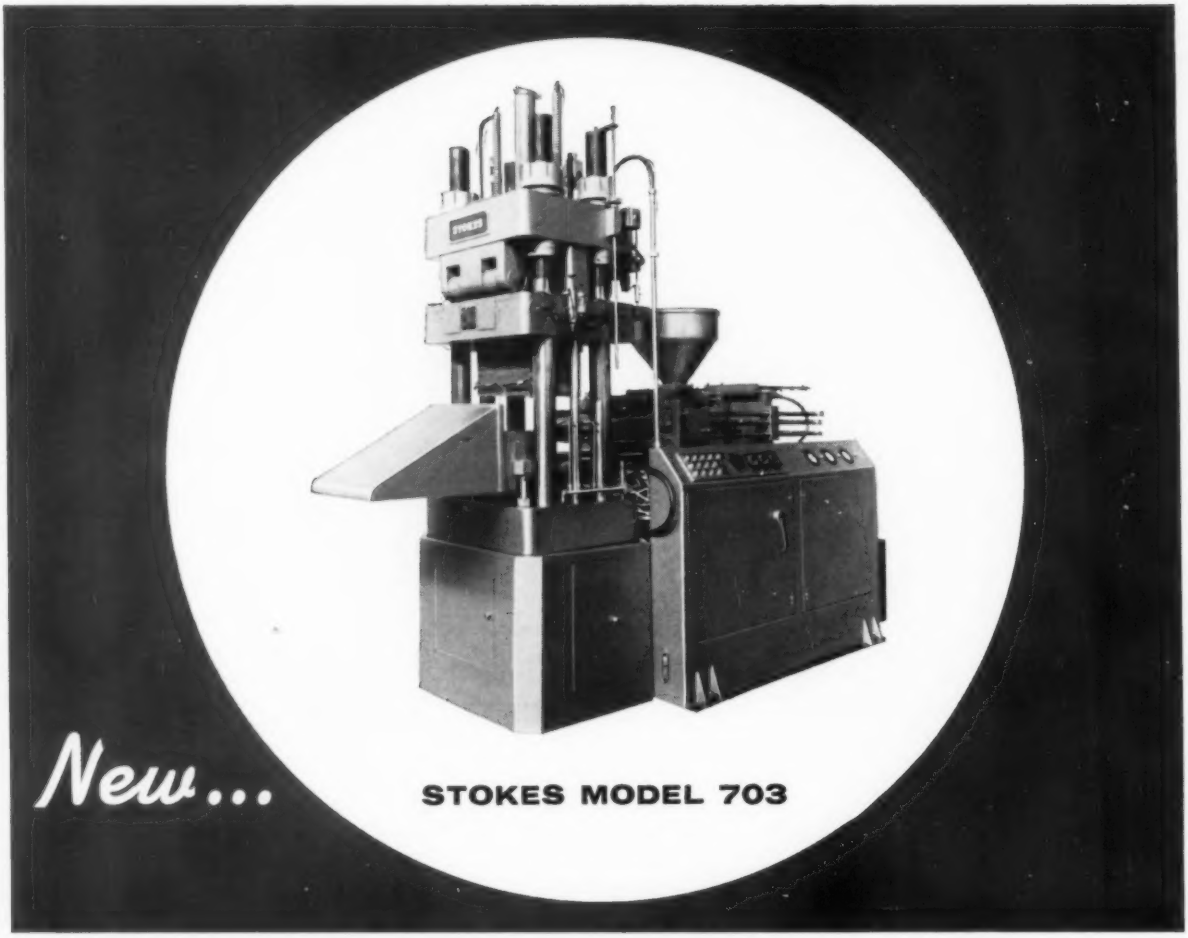


Fig. 5: Details of inside-center gating with runner through center of male member





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The 703 takes full advantage of its vertical design, combining vertical clamping with horizontal combing. Degated parts can be ejected into chutes, or deposited on a conveyor oriented as they were molded. Set-up and change-over is easy and quick—floor space is conserved—the mold is at an efficient working height.

All thermoplastic materials, including nylon, can be molded in the 703. An independently actuated positive nozzle shut-off prevents drooling. It also permits pre-packing the injection cylinder, precompression of the material at high pressure and faster filling. Center-point adjustment of the head insures keeping it absolutely level, preventing cocking of the mold. Automatic lubrication reduces wear and insures trouble-free service. Low pressure and controlled-speed closing provides greater safety to the mold—final clamping is fast, and at full pressure. Push-button type valves on the gages prolong their life.

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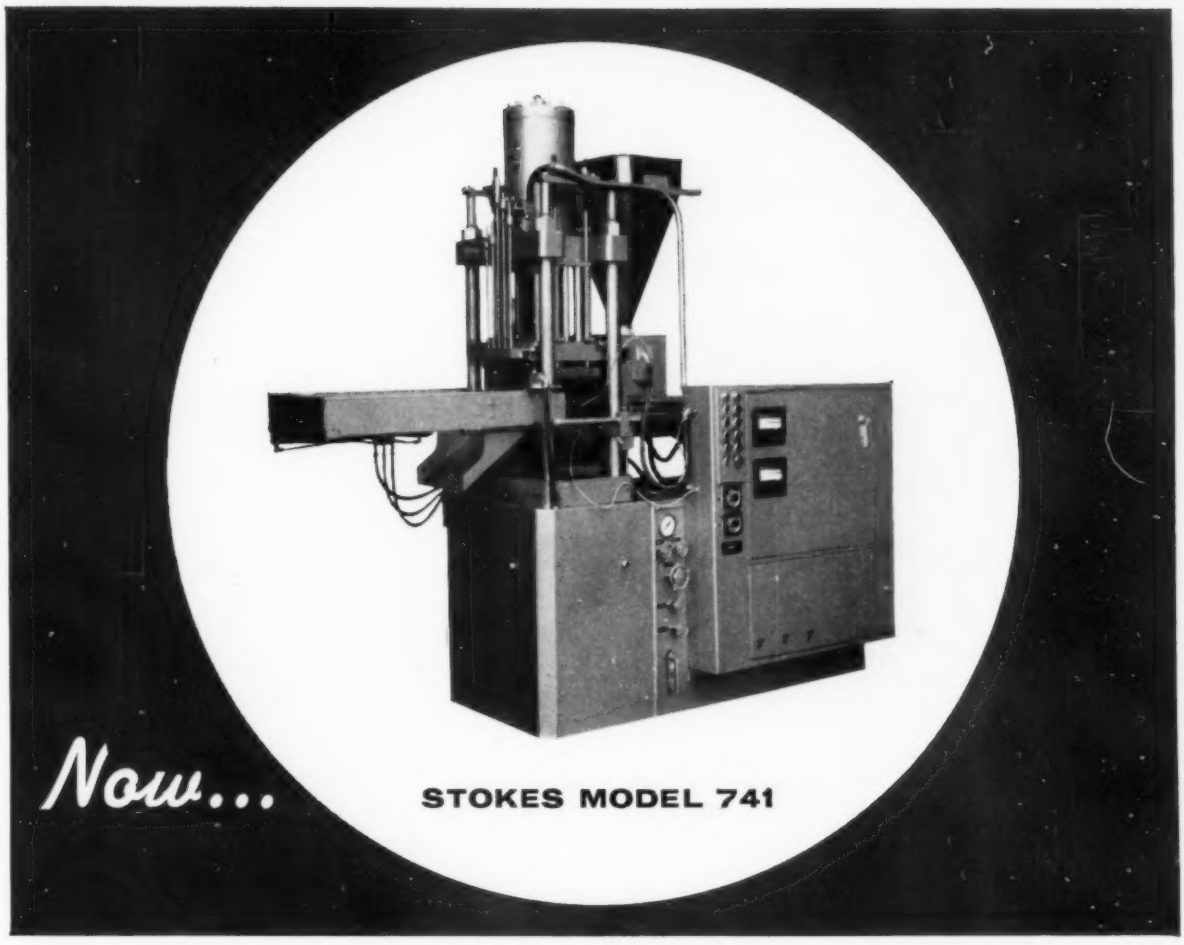

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Fig. 7: Hob for tapered closure with undercut monogram, at left, was used to press cavity in which closure, right, was molded

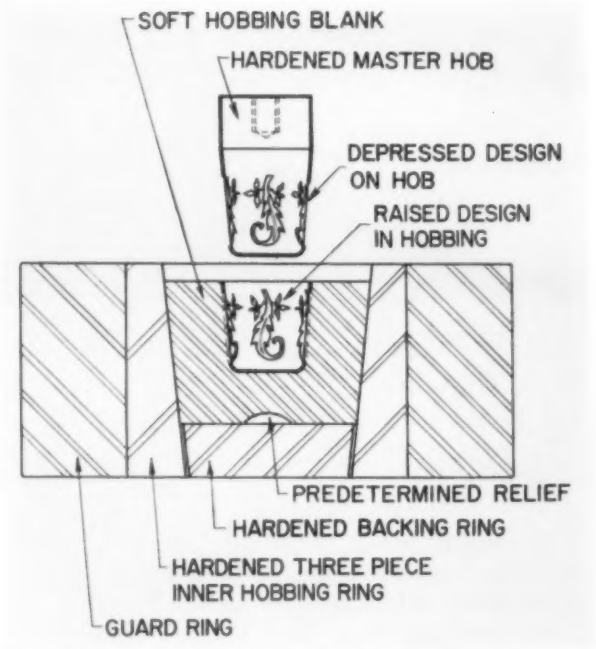

Fig. 8: Setup for hobbing cavity for closure with inset design in side surface

from the blank. If a true undercut is called for, the steel of the blank in the immediate vicinity of the undercut must not be compressed beyond its elastic limit; this requires close control of the hobbing pressure.

Successful hobbing of closure cavities requires careful preparation of the blanks, an art in itself. Unlike other machinists, the hobber works blind; he doesn't know if he's done the job properly until it's finished. Tough and hard as they are, hobs can be damaged. It takes only a few seconds to ruin a costly hob.

At one time, the design and machining of cores or forces for closures was left to the individual skilled mold maker, who used the general-purpose equipment available to him. Today, the producer of parts for automatic unscrewing molds uses duplicating machines designed to reproduce numbers of identical cores.

Conclusion

To achieve maximum economy in the production of molds for closures, one must standardize the mold designs, build parts that can be reliably interchanged, produce these parts by the most economical means, and provide fast delivery.—END

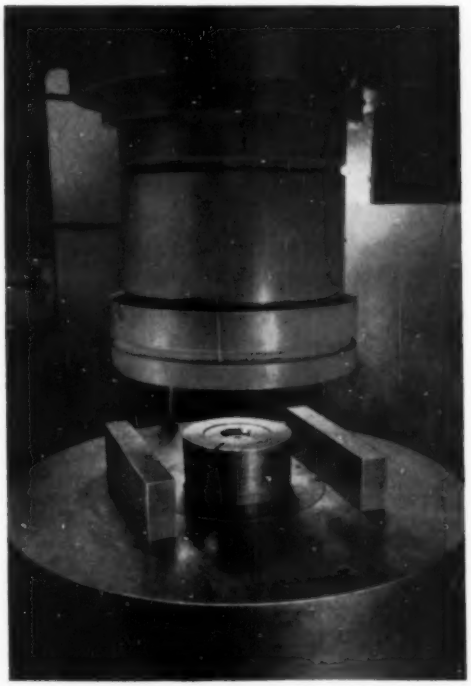

Fig. 9: Split-ring hobbing setup as it emerges from guard ring after pressing

PLASTICS FOR PROFITS

Sequential impact molding

Fast-acting, precisely timed valves in multiple nozzles make it possible to precompress the injection cylinder contents, then "explode" the melt into each cavity in sequence *for a six-fold increase in filling rate*

By G. D. Gilmore and Judson Decker†*

Anyone who has watched molten plastic spewing wildly, almost explosively, from a frozen nozzle that suddenly broke free while purging under full ram pressure can't fail to appreciate the tremendous energy available in the compressed melt. Yet in spite of the fact that most experienced molders have seen frozen nozzles break free, it was only recently that methods for taking advantage of this potential energy were announced (see box below). Sequential impact molding (SIM), developed over a five-year period and proved in production, is a method of utilizing this energy efficiently in making injection-molded articles. Further, SIM magnifies the benefits of this energy several-fold over what can be expected from applying the impact technique to conventional injection set-ups.

Sequential impact molding consists of compressing the plastic material in a heating cylinder, then directing this precompressed melt first to one cavity (or group of cavities), then to a second, and so forth until all have been filled individually in the course of a single injection cycle. Sequencing is accomplished by timed opening and closing of valves in a multiple-nozzle manifold. The principal advantage of this method over valve gating, which might also be operated sequentially, is that all the special equipment is in the injection end of the machine rather than in the mold. Thus, one valving set-up suffices for many different molds.

Figure 1, above, is a sketch of a typical two-nozzle system with a flow-control valve in each nozzle. Figure 2, p. 188, is a photo of a pressure manifold with four flow-control valves, permitting the sequential impact molding of four units or groups of units. The valves themselves are small and simply designed for fast action, yet rugged enough

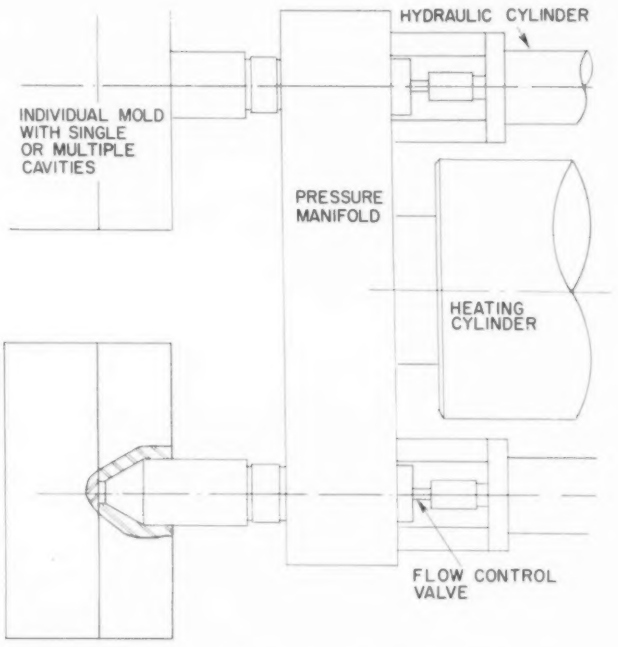

Fig. 1: Schematic diagram of two-nozzle layout for sequential impact molding, using two separate molds

Editor's note: Last January the first public announcement was made of a new idea in injection molding: precompressing the melt with the aid of valves (see "Valve gating of injection molds," M. PL. Sept. 1958, p. 117). Since then we have learned that others have been working with the same basic notion for some time, and at the September meeting of the Newark SPE Section, representatives of both F. J. Stokes Corp. and Impco, Inc. described nozzle valves intended for "precompressed" or "impact" molding. The authors of the present article, who have been developing and using nozzle valves of their own design for five years, and have patent applications pending, show how impact molding can be made to pay even greater dividends by sequencing the operation of multiple nozzles.

* Vice-Pres., Engineering, and † Vice Pres., Gen. Mgr., Bopp-Decker Plastics, Inc., Clawson, Mich.

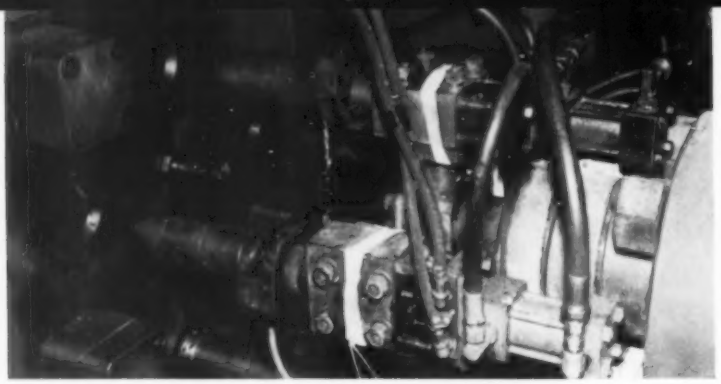

Fig. 2: Four-nozzle set-up for SIM, showing manifold, nozzles, and valve cylinders

to withstand repeated cycling with positive shut-off.

As the plunger starts forward, all the valves in the manifold are closed. The plunger advances, compressing the granular and molten material in the cylinder. Then the first valve opens, allowing compressed material to "explode" into the cavity (or group of cavities). The injection plunger, which is set at full speed and pressure, completes the filling of any portion of the cavity not completely filled by the decompressive impact. Filling of thin-walled containers has been completed in most cases in a fraction of a second.

When the first cavity is completely filled, the valve closes, locking the pressure on the material in the first segment of the die. Then the second segment is filled in the same manner, the slight delay between the closing of the first and opening of the second sufficing to restore the material in the cylinder to full compression.

When the last cavity or group has been filled, the plunger returns for a new charge. Before the mold is opened, all the valves in the manifold open momentarily to allow the still compressed material between the valve and the cavity gate to bleed back into the manifold and cylinder. Before the cycle repeats, the valves are again closed.

As will be shown later, the injection rates obtained by impact molding are many times those which would be reached with the same hydraulic system operated in the conventional way. To achieve such rates without precompression, though theoretically possible, would require a hydraulic system of enormous size and cost.

Of course, all the cavities could be filled in a single operation, using only one nozzle and valve, with some advantage over conventional procedure, but the potential energy of decompression is then divided instead of concentrated as in SIM.

Figure 3, below, shows the construction of a typical valve used in sequential molding. The arrows in the channels show the direction of melt flow during injection. The valve is closed by a small, high-speed hydraulic cylinder, opened by the melt pressure when hydraulic pressure is relieved on the closing cylinder. Total movement is small, and the valve can go from fully open to fully closed in about 2 milliseconds. Timing of valve movements is adjustable to within 20 milliseconds. The enlarged section on the valve stem serves three functions: 1) to limit impact loading on the valve seat, 2) to control the stroke, 3) to act as a seal in open and closed positions.

Why SIM works

To arrive at an evaluation of SIM, we must first review what occurs in a normal injection cycle. Injection machine specifications refer, directly or indirectly, to "injection rate," which is the maximum volumetric displacement rate that the ram is capable of developing. However, this is only a relative indication of the actual flow rate of melt into the mold. In most cases, the actual "melt injection rate" is only a fraction of the nominal maximum "injection rate" of the plunger. The relatively high compressibility of thermoplastics greatly reduces the effective speed with which the melt can be injected into a mold.

The diagram in Fig. 4, p. 190, helps to make the point clear. A plunger capable of developing 20,000 p.s.i. at a displacement rate of 10 cu. in./sec. pushes against loosely packed granules amounting to one shot weighing 4 ounces. These granules in turn push against the melt, forcing it through the nozzle and into the mold. Very soon after the plunger starts compressing the loose granules, pressure in the melt has built up enough to start it filling the mold. The resistance in the system, and the ram pressure, gradually increase, reaching their greatest values at or near the end of filling. The volume changes occurring during the stroke are, therefore, indicated as follows:

1) The shot volume, ΔV_s, amounting to about 6.5 cu. in. for polystyrene, moves from the cylinder into the mold.

2) The melt region in the heating chamber is compressed by an amount ΔV_m.

3) The granular region in the heating chamber is compacted by an amount ΔV_g.

4) The plunger has moved forward and displaced a volume

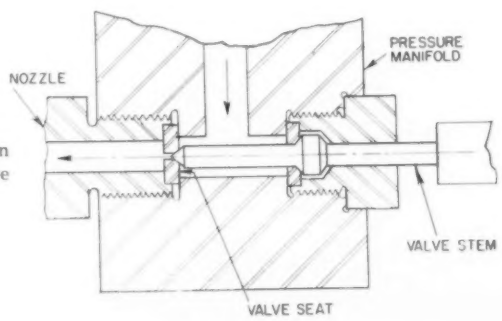

Fig. 3: Cross section of typical nozzle valve

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The individual packages consist of a sheathlike container and a heat-sealed cap. Molded lugs on the inside of the container hold the needle securely so that the sensitive point never touches the walls—an assurance that it reaches the patient factory-sharp.

Not only an excellent protection for the needles during shipment and long shelf life, the tough polyethylene containers also facilitate quick identification and selection. They are color-coded to needle gage, and each unit also is imprinted with length and gage information.

At the point of use, it is a simple operation to break the seal and remove the cap. The molded lugs within the package allow users to lock the needle hub onto the waiting syringe without ever touching it. Another time-saving feature is that the container sheath can be left on until the last moment, thereby eliminating the usual need for wiping the needle with an alcohol-soaked sponge or cotton to protect its sterility.

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ΔV_p, equal to the sum of the above volume changes, i.e.:

$$\Delta V_p = \Delta V_s + \Delta V_m + \Delta V_g \quad \text{Eq. 1}$$

For a shot size of 4 oz. or 6.5 cu. in., a representative heating chamber would contain 50 cu. in. of melt. The change in volume of this quantity of melt in going from 0 to about 10,000 p.s.i. at 400°F. may be calculated from the equation of state for polystyrene given by Spencer and Gilmore (M. PL., April 1950, p. 143). For the purpose here, this equation may be written

$$V = \frac{11.18\,t + 5134}{P + 27{,}000} + 1.422 \quad \text{Eq. 2}$$

where V = the specific volume of polystyrene at a pressure p in p.s.i. and temperature t in °F. From Eq. 2, the specific volumes at 400° F. and 0 and 10,000 p.s.i., respectively, are 1.778 and 1.682 cu. in./ounce. Thus the melt is compressed 5.4% or 2.7 cu. in. as the pressure rises to 10,000 p.s.i. From another equation presented by the same authors (J. Appl. Phys., 1950, p. 527), it can be calculated that the 11.7 cu. in. of granules will be compressed by about 4 cubic inches. Adding all these changes, the piston displacement becomes $\Delta V_p = 6.5 + 2.7 + 4.0 = 13.2$ cubic inches. At a ram advance rate of 10 cu. in./sec., these volume changes would be accomplished in 1.32 seconds. During this time, only 6.5 cu. in. of melt have moved into the mold. The actual "melt injection rate" is, therefore, only $6.5/1.32 = 4.9$ cu. in./sec., less than half the nominal.

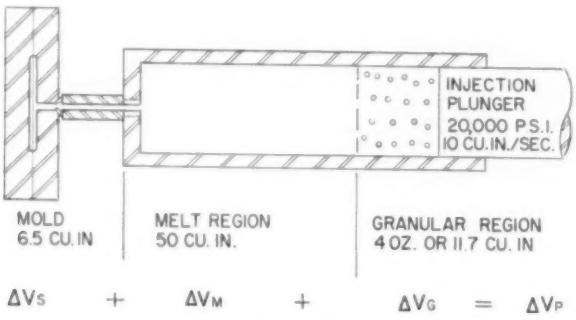

Fig. 4: Diagram showing how volume changes during injection contribute to ram displacement

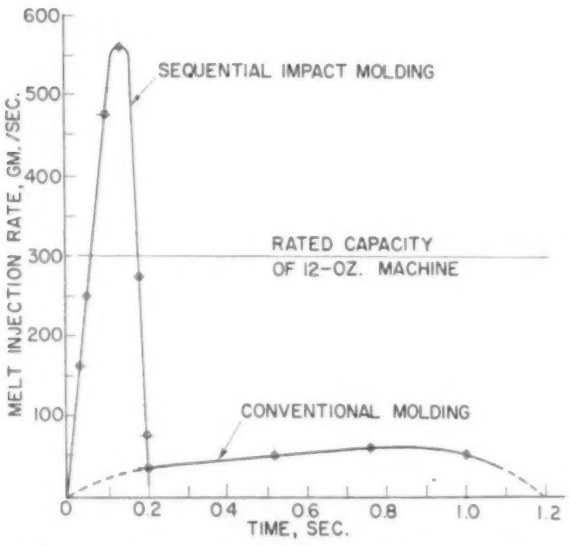

Fig. 5: Filling rate graphs for two half-gallon containers molded under identical conditions by sequential impact molding and by conventional means

Since the compacting of a relatively small volume of particles contributes as big a share to ΔV_p as the compression of a large volume of melt, it is clear that the actual shooting rate would be even lower if the ratio of granule volume to melt volume were to increase. Conversely, in a machine having a preplasticator, there would be no granules in the injection cylinder and the actual injection rate would be nearer the nominal.

To summarize: because of the compressibility of plastic melts and the compactibility of granules, the actual injection rate is about half the nominal ram displacement rate in most conventional injection molding operations, and maximum pressure is not developed until close to the end of the filling time.

That the sudden decompression used in SIM greatly augments the actual filling rate was verified, as follows: In molding half-gallon containers from high-impact polystyrene on a 12-oz. machine, short shots were deliberately molded at various filling times below the normal for both conventional and SIM operation. The filling time was noted and the weight of each corresponding shot recorded. Filling time could be controlled to within a few hundredths of a second by adjusting the shut-off time of the valves.

In the conventional molding tests, of course, the valves were opened at the beginning of the ram advance. Dividing shot weight by filling time gives the average weight rate of filling over the interval. This entire procedure was repeated several times and the resulting rates averaged to give the points on the graphs in Fig. 5, left. Since the time required to completely fill the cavity by SIM was only one-sixth as great as by conventional operation, the effective filling rate was increased 6-fold.

SIM saves money

Increases output: There are many ways to take advantage of this rapid filling, though it probably won't be possible to realize all these advantages simultaneously. Temperatures and cycle

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Fig. 6: Half-gallon containers short-shot by SIM (left), and by conventional method show that filling proceeds more evenly in all directions by SIM

times may be reduced, or additional cavities may be added with only slight increases in cycle times; in either case there is a gain in productivity. In four years of production experience, we have found that SIM has yielded from 30 to 50% more pounds per hour of finished pieces than the top yields from the same equipment with conventional procedures.

Eliminates core shifting and weld lines: Because the cavity is filled so much faster, the melt cools relatively little and its viscosity is still low when filling is complete. This drastically reduces the usual large, around-the-cavity pressure gradients that are responsible for core shifting in bottom-gated cavities. With conventional molding, cores shifted as much as 8 mils. Increasing the plunger-forward time only resulted in flashing one cavity before either cavity was filled. Higher cylinder and mold temperatures were the only solution, and mold temperatures had to be meticulously balanced to equalize rates of fill.

When molded by SIM, the same cavities filled uniformly with section thickness control within 1.5 mils. Apparently, the initial surge starts flow in all directions that persists until the mold is filled. (See Fig. 6, above.) Core shifting was greatly reduced, weld lines eliminated.

No more warped pieces, better physicals: A serious consequence of slow filling in thin sections is the chilling of the melt while still in motion. The chilled melt is very viscous and high shear stresses are needed to move it. These stresses never get a chance to relax and are literally frozen-in, weakening the piece and causing it to warp after being removed from the mold. Sequential impact molding has eliminated warping in our shop.

Clamp requirements reduced: With SIM, only one cavity or group of cavities is filled at any one time. Therefore, the clamping force needed during each period of filling is much less than if all the cavities were filling together. Particularly with large-area parts, this allows an increase in the number of cavities without concern about clamping capacity. Should this limit be approached, precise timer control affords excellent control over any tendency to flash.

Simplified control: The most important single element of control in sequential impact molding is *time*. By using small, fast-acting valves, with precisely controlled timing, the amount of flow into the mold can easily be controlled. A large, relatively slow moving ram, acting through a mass of rubbery material in the conventional manner, is ineffective and erratic in controlling filling. With SIM, the initial in-rush is so fast that mold temperature is no longer critical. Molds can be cooled with chilled water at 40° F., and inter-cavity variation in mold temperature to control fill is unnecessary.

One problem in conventional molding with multiple cavities is the start-up time required to obtain a balance of ram pressure, speed, mold temperature, and plunger-forward time. With SIM, you simply adjust the valve timings; other factors remain essentially constant, and a given set-up can be quickly reproduced at some later date. The balancing of runners and gates within groups of cavities also becomes less critical when only a few cavities are filled at one time.

Tooling costs are lower: When molding two cavities by SIM, experience has shown that it is less costly to build two single-cavity molds and clamp them individually into the machine than it is to build one two-cavity mold in a single die base (see Fig. 1). Also, should one cavity need to be removed for maintenance, both do not have to be put out of action. Further, if reserve tooling is required for a particular job, a single-cavity mold would be sufficient for emergencies instead of a second two-cavity mold. Thus, reserve tooling investment is minimized.

A hot-runner mold is usually more expensive than several conventional molds totaling the same number of cavities. Since the existing pressure manifold serves in place of hot runners in the mold, and will serve for many molds of similar dimensions, more money is saved with future mold investments that can be adapted to a manifold on hand.

New heated nozzle

During the development of impact molding, we felt there was a real need for a nozzle that would allow prolonged interruptions in molding cycles without the danger of freezing off, yet would transfer minimum heat to the mold. The internally heated nozzle of Fig. 7, below, seems to meet these requirements. The cartridge heater's maximum out-

(*To page* 310)

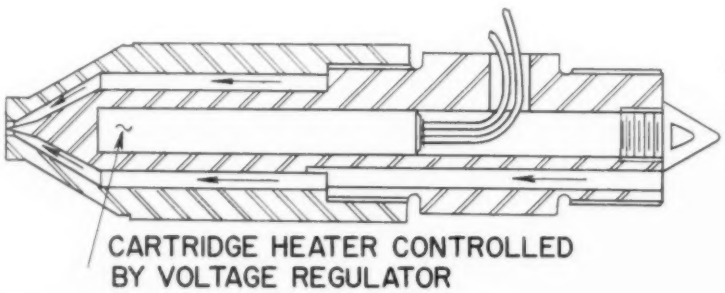

Fig. 7: Construction details of internally heated nozzle

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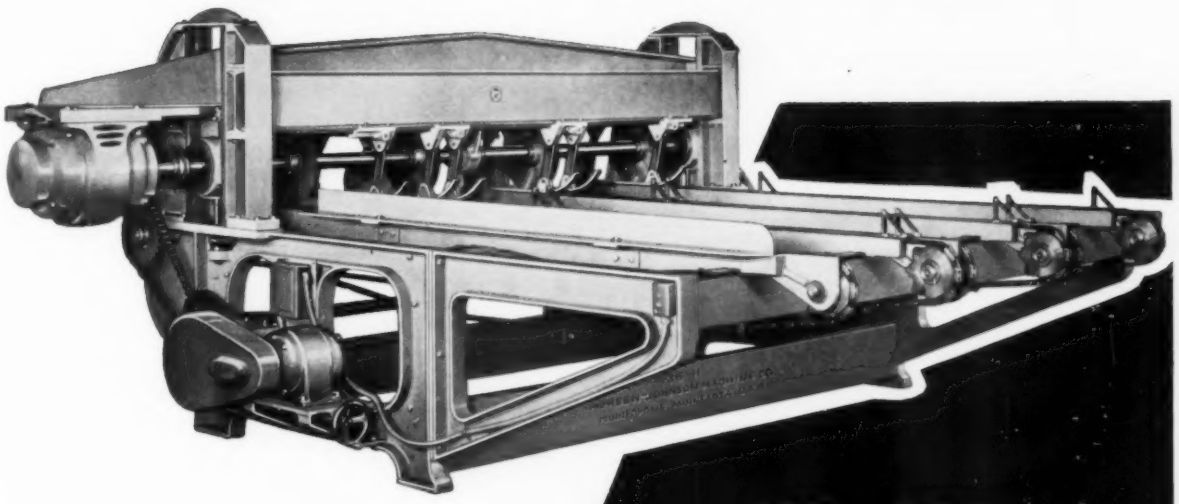

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Rear View of 144x48 Slat Bed Machine

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PLASTICS FOR PROFITS

Injection molding machine drives

Duty cycle evaluation of drive requirements may save up to 30% in power requirements and up to 25% in motor costs

*By F. R. Gloeckner**

In today's highly competitive market, it is well worthwhile to evaluate motor requirements on injection molding machines.

As an example: a typical 12-oz. injection molding machine is driven by an induction motor rated at 30 hp. (continuous duty). The motor is directly coupled to a hydraulic pump, which is a vane-type pump delivering about 65 gal./min. at 1000 p.s.i. When actuated, the hydraulic pump drives the injection plunger, which provides an injection pressure of approximately 20,000 p.s.i. Usually, two hydraulic pumps are used with a double-shaft motor; however, the two together can be treated as one equivalent unit.

The important factor, from a motor-selection standpoint, is the cyclic nature of the load. A typical 12-oz. machine can cycle about six times/min. when molding polystyrene. Cycle time and working loads on the drive may be higher if acrylics, cellulose acetate, or other materials are being molded. Nonetheless, the basic cycle on the motor will remain constant percentagewise—it will be operating at full load for about one-third of the total cycle time. In six-cycle/min. operation, full-load torque at the motor occurs six times/min., as the ram advances. In the total cycle time of 10 sec., the stroke lasts approximately 3.3 seconds. During the remaining 6.7 sec. the motor itself carries only friction, windage, and pump-idle load. Figure 1, above, is a graphical analysis of this cycle.

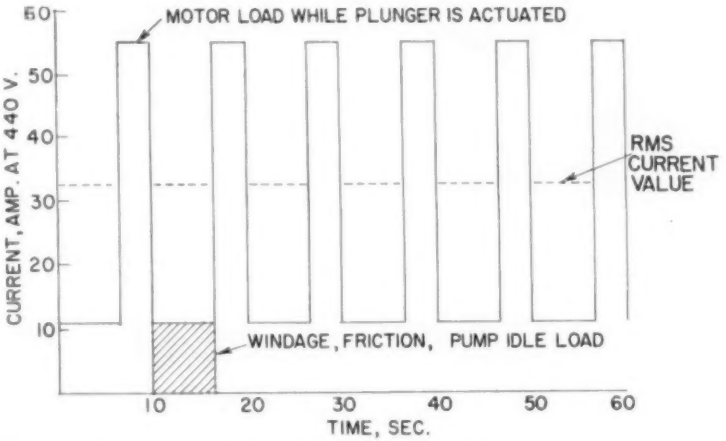

Fig. 1: Time current analysis indicated for the drive of a 12-oz. injection molding machine

What motor design factors should govern the choice of a motor for such cyclic service? It turns out that maximum torque rating and thermal capacity, rather than the conventional horsepower rating, are most important. Consider the typical speed/torque curve for an NEMA Design B, 30-hp., 1200-r.p.m., squirrel-cage induction motor in Fig. 2, p. 196. Such motors are now purchased for a majority of injection molding machines. Note that the NEMA guaranteed maximum torque is 200% of full load torque or 268 ft./lb. available. In actual practice, molding machine designers have been utilizing torque up to 125% of the full load torque for the cycling load.

Now consider a squirrel-cage induction motor rated at 20 hp. and 1200 r.p.m., designed specifically for the application. Since torque capacity is more important than the continuous-duty power rating, let one of the design specs be that the maximum torque is to be 350% of full load. Such

Table I: Comparison of NEMA B and high-torque motors

	30 hp. NEMA B	*20 hp. 350% max. torque*
List price	$1,020	$816
Full load current, amp. (440 v.)	32.8	32.2
Current at point of guaranteed max. torque, amp. (440 v.)	120	136
Efficiency at 30 hp., %	90.5	90
Power factor at 30 hp., %	85	63.5
Starting torque, ft./lb.	181	247
Max. torque, ft./lb.	268	313
NEMA frame	365U	326U

*Small AC Motor and Generator Dept., General Electric Co., Schenectady, N. Y.

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ERRORS NOT CUMULATIVE. Metering elements are integrated by electro-pneumatic controls for simultaneous proportional metering of the materials. This assures that the materials are in the required proportion at any time during the mix.

FAST OPERATION. Metering elements are readily adjustable for volume and speed. NoVo Systems average up to 120 individual dispensings per minute, or extrude a continuous bead of the mix.

MORE EFFICIENT MIXER-REACTOR. Simultaneous proportional metering makes possible a small net volume mixer-reactor with a high mixing rate.

NO AFTERDRIP. A special valve on the dispenser nozzle sharply cuts off flow at the end of the dispensing cycle.

MINIMUM MATERIAL LOSS when the equipment is shut down or cleaned out because of the small net volume mixer-reactor.

TEMPERATURE EASILY CONTROLLED because the mix flows through the mixer-reactor in a thin film. Mixer reactor is jacketed for heating or cooling. Runaway of exothermic reaction is prevented and pot-life is extended.

HOMOGENEOUS REACTIVE MIX ASSURED by the high rate of shear and feeding the mix components to the mixer-reactor in continuous proportion.

SHORT POT-LIFE RESINS READILY PROCESSED. Special design features eliminate stagnation areas and control material flow paths. No reactive mix can reach and freeze reactor seals.

QUICK CLEAN OUT. A solvent purge flushes out the reactive mix when shut-down time is any longer than the pot-life of the mix.

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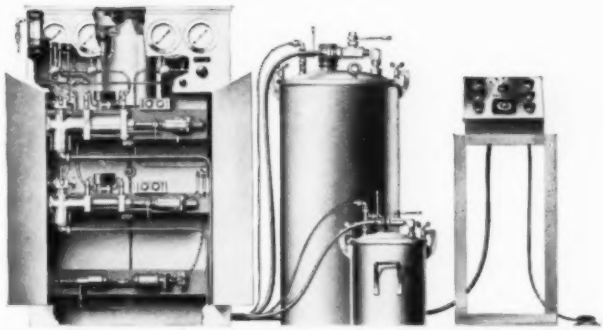

To Whom it May Concern:

PATENT NOTICE

The Proportional Metering, Mixing and Metered Dispensing Systems of Mitchell Specialty Division, Industrial Enterprises, Inc. is protected by Claims of Schneider Patent 2,788,953 of April 16, 1957, entitled "Automatic Proportional Metering, Mixing and Dispensing System".

For the information of the Industry, representative claims are here set forth:

CLAIM 1

A metered mixing system for mixing two substances in predetermined proportions comprising two separate feed systems, one for each substance, and each including a cyclical measuring and dispensing unit effective on each cycle to dispense a predetermined amount of a given substance, and a double-acting interlock operatively connected between said units and effective to prevent either unit from recycling until the other unit has completed its cycle, said cyclical measuring and dispensing units comprising positive displacement pumps to which two-position valves are operatively connected to control the output therefrom, movement of each valve from one position to another permitting the associated pump to dispense another quantum of the substance associated therewith, said interlock being sensitive to the condition of each of said pumps relative to the end of its cycle and operatively connected to said valves so as to initiate a new cycle of said pumps only after both said pumps have completed their original cycle.

CLAIM 7

A metered mixing system for mixing two substantially incompressible substances in predetermined proportions comprising two separate feed systems, one for each substance, each feed system comprising a reservoir, a measuring and dispensing unit connected thereto, a common receptacle into which each unit empties, and connections between said units and said receptacle and means active on each of said substances to force them from their reservoirs to said receptacle, said receptacle and said connections being closed and of fixed volume, said means being effective to maintain said units, connections and receptacle full of said substances, and said receptacle having means associated therewith for stopping or permitting dispensing independently of said feed systems.

CLAIM 18

In combination, a receptacle adapted to retain a supply of material, dispensing means associated with said receptacle, a primary control for said dispensing means, and an automatic control for said dispensing means comprising a first element measuring the amount of material dispensed and a second element measuring time, said second element being operatively connected to said dispensing means and effective to cause the latter to dispense material after a predetermined time period has been measured thereby, said first element being operatively connected to said second element and effective to reset itself and said second element whenever it measures a predetermined amount of material dispensed from said receptacle.

It is the intention of the Industrial Enterprises, Inc. to enforce its patent rights against infringers of that patent. One suit for infringement has already been brought. The industry is reminded that the user of a System coming within the scope of patent claims, as well as the manufacturer and seller, is an infringer and is liable as such to the patent owner.

*Patent No. 2,788,953

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designs are commercially available in the same NEMA frame sizes as an NEMA B motor. The typical speed/torque curve now looks like the solid line in Fig. 3, below. Note that while the power rating is only two-thirds of the NEMA B rating, the maximum guaranteed torque is 350% of full load torque. With the 20-hp. motor, 313 ft./lb. of torque are available for the cycling operation. Thus, peak torque is *increased* 17 percent.

Design limitations

What are the limitations of such a design? Fundamentally, the limiting factors are motor thermal capacity and flux densities. To realize dollar savings in motor purchases, the design should be limited to Class A insulation: i.e., temperature rises of 40°C. for open motors; 55°C. for enclosed motors. Also, the flux density of the motor design must be kept to a reasonable level to avoid paying a premium in the form of drastically reduced efficiency and power factor. Usually, the maximum torque rating should be held at 350 to 400% of full load torque for greatest cost savings and optimum motor characteristics. Table I, p. 194, gives a comparison of a 20-hp., 350%-torque motor with an NEMA B, 30-hp., 1200-r.p.m., 200%-torque motor.

Duty cycle evaluation has reduced the motor frame size from 365U to 326U, saving valuable size and weight. A net dollar savings of approximately $125 per motor has been realized. Although minor decreases in efficiency are evident, these decreases represent less than 1 percent. Available torque has been increased over 15 percent. Power factor, while low during the point of maximum torque, may be corrected with capacitors and, when figured on total cycle, represents only about 7% less overall.

Admittedly, this analysis is based on a single machine and, therefore, the conclusions may not apply to other types of machinery. The results are sufficiently encouraging, however, to warrant engineers' time and efforts in this direction.—END

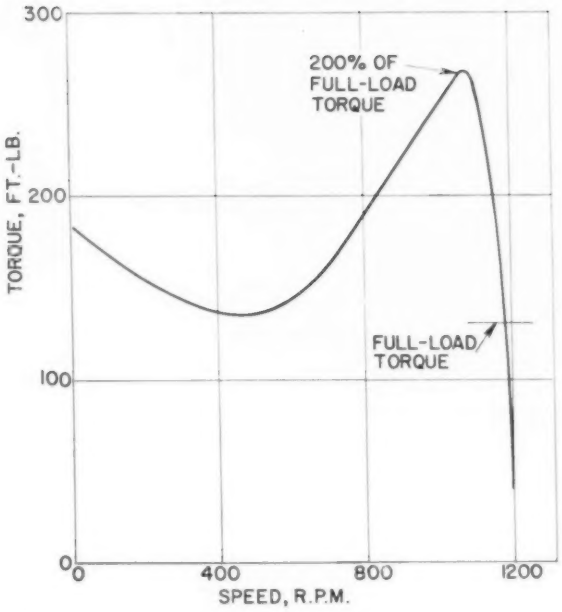

Fig. 2: Typical operating characteristic curve for squirrel-cage motor of NEMA B design rated for 30 hp. at 1200 r.p.m.

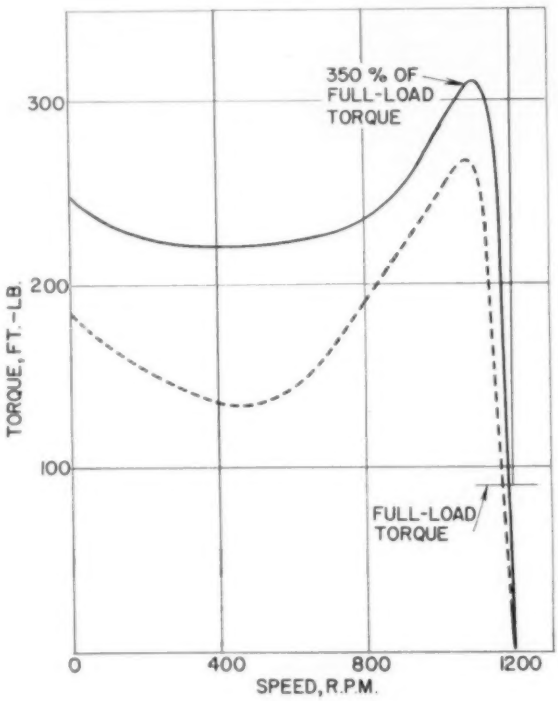

Fig. 3: Solid line: operating characteristic for high-torque motor rated for 20 hp. at 1200 r.p.m. Compare this with the NEMA B 30-hp. motor (dashed line)

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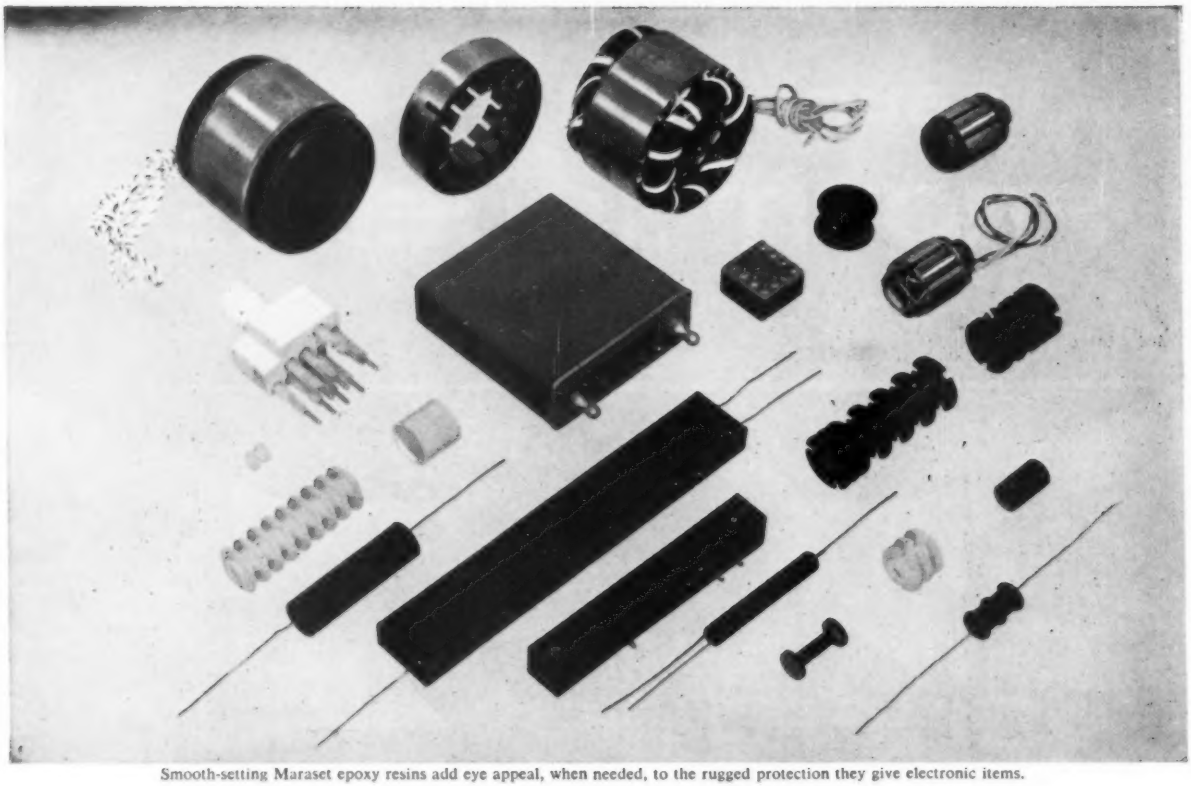

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Plastics Technical Section

Dr. Gordon M. Kline, Technical Editor

Chemical and physical changes in gamma-irradiated plastics

By Robert Harrington[†] *and Richard Giberson*[†]

Several plastics were irradiated in a gamma radiation source at various doses out to 1×10^9 r. Of these materials classified as polycarbonates, polyethylenes, polyfluorocarbons, polyesters, polystyrenes, and polyvinyl chlorides, the aromatic-containing carbonate, polyester, and styrene materials were found to be the most resistant to the damaging effects of radiation as reflected in both chemical and physical property changes. The low-density-type polyethylenes were next with the plasticized polyvinyl chlorides following. The high-density polyethylene was considerably poorer than the low density types of more severe oxidation occurring in the thin specimens evaluated. The fluorocarbon was the poorest of the materials studied. To completely classify all of the above materials more irradiations are needed at higher exposures.

To best utilize the unique properties of plastics materials of construction for applications where radiation exists, it is of prime importance to ascertain beforehand their capabilities and limitations in radiation fields. This can be accomplished in basically two ways: 1) by a study of the physical property changes induced by radiation, and 2) by a study of the chemical changes induced which are ultimately responsible for the physical changes (1).[‡] The former method appears to be most widely used for the more immediate needs of practical application of plastics where radiation exists. In general, this procedure consists of exposing the materials to the desired radiation dose in a relatively short time by using substantially higher radiation dose rates than will be encountered in service. Thus, the evaluation procedure can be done in a matter of a few hours or days rather than weeks or years. After the exposures, the materials are examined physically (often with particular emphasis on those properties which are of most importance for the application) to obtain the desired information. The latter method listed above consists in studying the chemical changes induced by radiation. For the work reported here, infra-red techniques were used to determine changes occurring in the molecular structure of the materials after having been subjected to radiation bombardment. This technique was supplemented by mass spectograph analyses of any gaseous products given off during the irradiation of the materials in vacuo. The study of chemical changes has been used more for studies basic to radiation chemistry and mechanisms of change rather than for determining materials' suitability for use in radiation fields.

The work reported here was undertaken to determine the suitability of combining the above two methods of study by correlating physical property changes with the infra-red analyses of molecular or chemical changes, as well as to obtain information on the actual chemical changes that were taking place to eventually cause the physical property changes.

This report covers irradiations in air and in vacuo out to a gamma dose of 1×10^8 roentgens (one irradiation was carried out to 3×10^8 r.); future reports are planned that will include more materials and irradiations out to 1×10^9 roentgens.

Materials: Table I, p. 206, lists the various plastics evaluated. Because of the demands imposed by the infra-red studies, films in the nominal thickness range of 3 to 20 mils were used for the major part of this work. Thus, by selecting materials with varying thick-

* Reg. U. S. Pat. Off.

† Hanford Laboratories Operation, General Electric Co.

‡ Numbers in parentheses link to references at end of article.

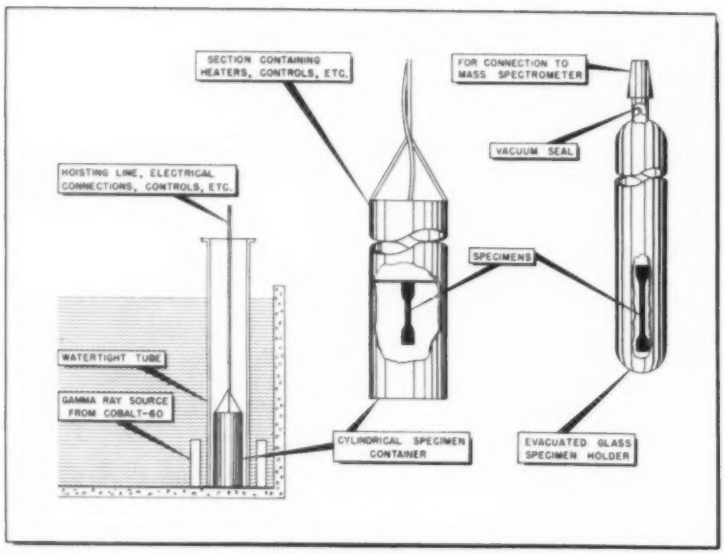

Fig. 1: Schematic diagram of cobalt-60 source and arrangement of specimens being irradiated

ness, chemical and physical changes as a function of specimen thickness could be determined.

Experimental procedures

Infra-red: The infra-red measurements (2,3) were made using a Perkin-Elmer Model 12-C spectrometer which had been modified for double-pass operation. Atmospheric absorption was reduced by blowing dry air through the monochromator housing. Sodium chloride (NaCl) optics were used from 4000 to 650 $cm.^{-1}$ Measurements were taken on the same specimens that were used for the physical property studies.

Mass spectrometer: Analysis of gaseous products consisted of semi-quantitatively measuring the masses of chemical compounds given off from organic polymers after irradiation in vacuo. This technique gives information on the chemical nature of the gaseous products and is helpful in the interpretation of the infra-red observations.

Tensile strength and ultimate elongation: Measurements were made in accordance with ASTM D 412-51T using Die C type dumbbell test specimens and a Scott tensile tester.

Flexibility: A 180° bend test was made after the radiation exposures by folding the tensile specimen back on itself. Positive finger pressure was applied to insure that the specimen sides were in contact and to reduce the radius of bend to a minimum.

Irradiation: All materials were exposed to approximately 1.24 mev. gamma radiation from a cobalt-60 isotope source of about 30,000 curies strength emitting gamma rays at a dose rate of about 1.3×10^6 r./hr. The irradiations were carried out in air at 25° C. at normal atmospheric pressure except for those in vacuo at 25° C. Figure 1, above, shows a schematic diagram of the Hanford cobalt-60 source used and the arrangement of the specimens being irradiated.

Units of radiation dose or exposure are given in terms of the roentgen (r.). This unit is equal to the gamma ray ionization producing one electrostatic unit of charge in 1 cc. of air and is equivalent to the absorption of 83.3 ergs of energy per gram of air. Dose rate, the amount of energy available for absorption in a material per unit time, is expressed as roentgens per hour (r./hr.). Millions of roentgens or megaroentgens is expressed as mr.

The infra-red measurements were taken on one end of each of two tensile specimens after a 1 hr. conditioning period at 25° C. and 50% relative humidity. These measurements were made approximately 4 hr. after the specimens had been removed from the radiation source. The reported optical density values are calculated from the average percent transmission readings of the two specimens. The average readings of the two specimens agreed to within ±2 percent.

Physical property measurements were made at 25° C. and 50% relative humidity on each of five test specimens approximately 1 hr. after the infra-red analyses. Each reported percent change value was calculated from the arithmetic average of the five measured values. A statistical analysis of typical data showed that the 95% confidence limits were approximately ±8% for tensile strength and ±10% for elongation.

Mass spectrometer analyses of the contents of the evacuated containers were made on all materials irradiated in vacuo. In these instances there was a delay of about a day before the infra-red and physical tests could be made. Data from the mass spectrometer included the percentages and total pressures of any gaseous products formed during the irradiations. Data reported are accurate to within ±1% for the major constituent.

Results

The infra-red and physical property data obtained from exposing the plastics to various doses of gamma radiation in air and in vacuo at 25° C. are presented in Table II, p. 208. This table shows physical property changes induced by exposure to gamma radiation as percent change of the original property values which are given opposite zero irradiation dose. Results of the infra-red studies on the same irradiated plastics are shown in the table under chemical properties. Units given are optical densities, log (T_o/T), where T_o has been corrected to $T_o = 100\%$ by the "baseline" method (2). The optical densities are proportional to the concentrations assuming Beer's Law to hold true. The structural groups and frequencies at which the absorptions were measured are given in Table III, p. 212. Original optical densities of the unirradiated materials are shown opposite zero irradiation

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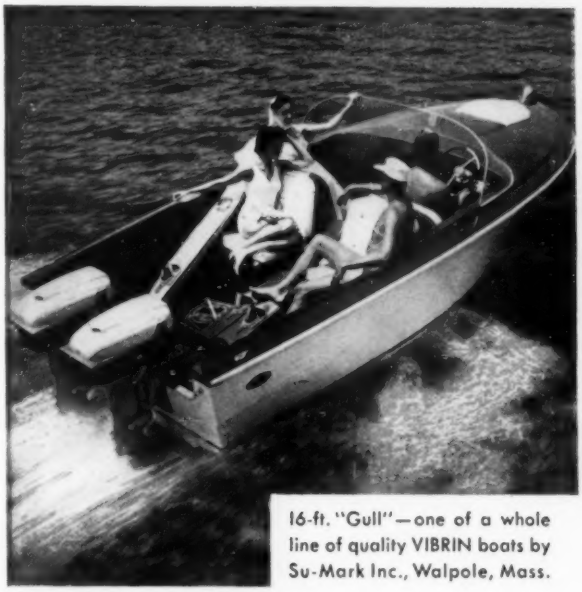

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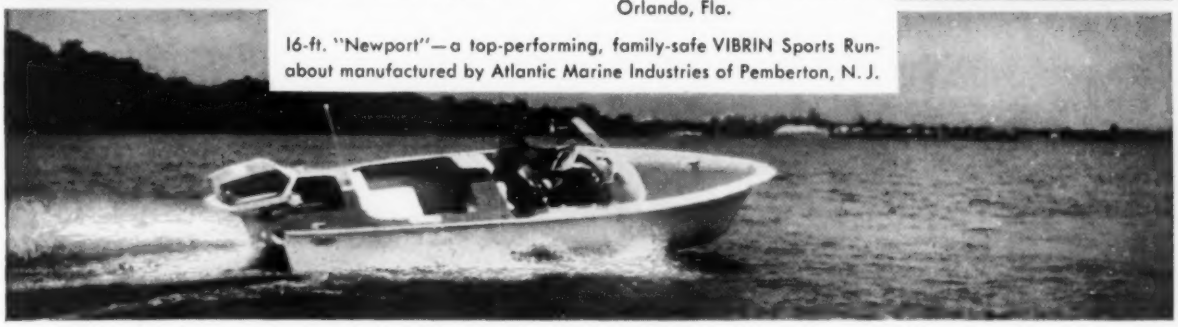

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dose in Table II. Also shown opposite zero irradiation dose and under the remarks column is the original color of each material. Significant color changes and other observations needing comment are also noted in this column opposite the particular radiation dose causing the phenomenon.

Results of the mass spectrometer analyses are given in Table IV, p. 220. This table shows the various gaseous products formed from the irradiation of each plastic in vacuo. These products are identified from data on their respective masses. The mass spectrometer technique will not sharply define products whose masses vary by about two mass units. For example, C_2H_4 could be either ethane or ethylene with masses of 30 and 28, respectively.

The data presented in Table II show how gamma radiation affects the chemical structures and physical properties of plastics classified as carbonate, ethylene, fluorocarbon, polyester, styrene, and vinyl chloride. Chemical changes induced by exposure to radiation cannot always be determined by a combination of the infra-red and mass spectrometer techniques. On the other hand, chemical changes which are taking place (1) but are not detectable, are in almost every case reflected in physical property changes. At short and intermediate doses, some of the materials are not significantly changed or damaged, but at the higher exposures all of the materials were more or less damaged depending upon their chemical composition or structure.

It is not the purpose here, with respect to chemical structure changes, to assign vibrational modes to all the infra-red bands observed, but rather to take those in which changes are observed and assignments well established, and comment on them. The principal effects discussed are unsaturation, oxidation, and results from the mass spectrometer for each material studied.

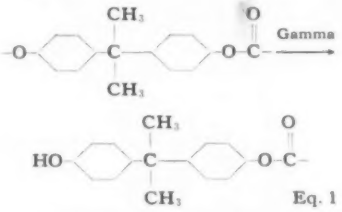
Carbonates

Lexan[2] and Macrofol have essentially identical spectra (see Fig. 2, below) and are considered identical for the chemical discussion. The variation in optical density values reported are attributed to thickness differences.

There is noted in these samples a number of bands in the unsaturation region 875 to 1000 cm.$^{-1}$ and also relative changes in these with irradiation. On the basis of available structural information (4) the assignment of these bands to unsaturation is difficult, and since the changes are minor, no such correlation will be assumed here.

The effect of oxidation is more readily determined. There is evidence of increasing carbonyl content at about 1750 cm.$^{-1}$. The high frequency of this group is attributed to the —OCOO— group. The optical densities in Table II are not too accurate because of the large intensities involved, even in the unirradiated specimens. There are definite shoulders found on the high wavelength side which can be attributed to ketone and acid carbonyl (5). The hydroxyl (—OH) absorption increases with radiation exposure to a total dose of 3×10^8 roentgens.

Samples of Macrofol were irradiated in vacuo to a total dose of 1×10^8 roentgens. There was insufficient gas evolution to determine gaseous products by the mass spectrometer technique. There was no indication of carbonyl formation, but the hydroxyl increase was identical with that for the irradiation in air. On this evidence it is suggested that a chain cleavage or depolymerization reaction may be responsible:



Eq. 1

Figure 3, p. 204, shows how chemical and physical changes of Lexan[2] are affected by exposure to gamma radiation. Both Lexan[2] and Macrofol behaved almost identically with respect to physical property changes induced by exposure to ionizing radiation. At the initial dose of 5×10^6 r. both materials exhibited a slight improvement in both tensile strength and elongation. Both of these properties were lowered at a slight rate with increased exposure to radiation out to about 5×10^7 roentgens. Further exposure out to 1×10^8 r. increased the rate of degradation of both properties, but the materials were in good condition and possessed much of their original flexibility and toughness. Both materials became more yellow in color with increased exposure to radiation. Lexan[2] that was exposed to a dose of 3×10^8 r. became quite brittle and could not be tested for physical properties. As the properties of Macrofol were changed about equally for both the air and vacuum irradiations out to 1×10^8 r., it appears that oxidation does not play a major role in the degradation of the carbonate plastics.

Ethylenes

The three different types of polyethylene studied here included a "conventional" or low-

[2] A registered General Electric trademark for polycarbonate film.

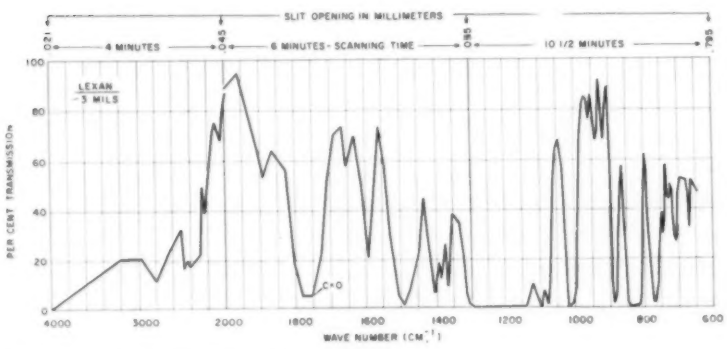


Fig. 2: Original spectra of polycarbonate

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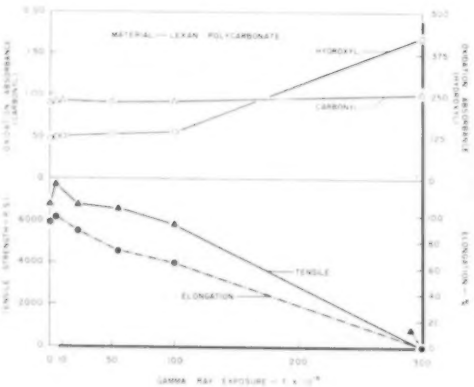

Fig. 3: Chemical and physical changes in a polycarbonate plastic, which were induced by exposure to gamma radiation in air at 25° C.

density type, Alathon 3, NC-10; a "linear" or high-density type, Marlex; and a low-density type which had been given a controlled electron radiation dose to improve some of its properties, Irrathene.[3] The original spectra of these materials are reproduced in Fig. 4, p. 210. Basic differences are noted in the unsaturation region 1000 to 850 cm.$^{-1}$, and in the 725 cm.$^{-1}$ doublet. Marlex shows vinyl unsaturation ($RCH=CH_2$) at 909 cm.$^{-1}$. Alathon 3, NC-10 and Irrathene[3] have a peak at about 888 cm.$^{-1}$ which is assigned to vinylidene ($RR'C=CH_2$), and the Irrathene[3] has an initial peak at 964 cm.$^{-1}$ for transvinylene (RCH =CHR) (6).

A large amount of work has been done on the chemical changes in irradiated polyethylene. The work of Dole (7) and Miller (8) are cited as being typical. In general, radiation has been found to decrease vinyl and vinylidene unsaturation and increase transvinylene. For irradiations carried out in air an increase in carbonyl at about 1720 cm.$^{-1}$ is also observed. The 725 cm.$^{-1}$ doublet is further split into branches at 730 and 720 cm.$^{-1}$ which is only observable in thin films 3 mils or less in thickness. The 720 cm.$^{-1}$ band is the most intense in Alathon and Irrathene[3] originally, and least intense in the case of Marlex. With increasing dose, the relative intensities of these bands shift in the Irrathene,[3] but remain unchanged in the other two materials.

Alathon 3, NC-10 polyethylene film: Table IV, p. 220, shows that 97.5% of the gas evolved from this material at a dose of 1×10^8 r. is hydrogen. This is in excellent agreement with Dole (7) and Charleby (9) for pile irradiation of polyethylene. Each hydrogen molecule liberated would result in one carbon to carbon bond being formed since oxidation can not occur in vacuo. The formation of transvinylene unsaturation as well as crosslinking could result:

$$R\text{-}CH_2\text{-}CH_2\text{-}R \xrightarrow{\text{Gamma}} RCH\text{-}CHR + H_2 \quad \text{Eq. 2}$$

$$R\text{-}CH_2\text{-}CH_2\text{-}R + R\text{-}CH_2\text{-}CH_2\text{-}R \xrightarrow{\text{Gamma}} \begin{matrix} R\text{-}CH\text{-}CH_2\text{-}R \\ | \\ R\text{-}CH\text{-}CH_2\text{-}R \end{matrix} + H_2 \quad \text{Eq. 3}$$

The mechanism suggested is free radical with one or two ionizing events (10). The radiation yield (molecules/100 e.v.) for transunsaturation in Alathon at 1×10^8 r. in vacuo is G (−C= C−) 2.7 based on Anderson and Seyfried's specific absorption coefficient (11) while the hydrogen yield was G (H_2) 5.3. Thus, about 50% of the hydrogen evolved resulted in intermolecular crosslinks.

It has been suggested that the vinylidene site is contributing to crosslinking (7). The vinylidene group does not decrease as rapidly when irradiated in vacuo as in air, indicating oxidation as a factor in removing this group. The tertiary carbon atom as well as the double bond would be vulnerable to oxidative attack. The formation of ketone groups well within the polymer chains as well as acid and aldehyde carbonyl are indicated in the infra-red spectrum (5). From a mechanism suggested by Dole (7), the following crosslinking reaction results:

$$\begin{matrix} R\text{-}CH_2\text{-}C\text{-}CH_2\text{-}R \\ \| \\ CH_2 \end{matrix} \xrightarrow{\text{Gamma}} + R\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}R$$

$$R\text{-}CH_2\text{-}\begin{matrix} CH\text{-}CH_2\text{-}R \\ | \\ CH_2 \\ | \\ R\text{-}CH_2\text{-}CH\text{-}CH_2\text{-}R \end{matrix} \quad \text{Eq. 4}$$

In Alathon the terminal groups or chain ends are almost exclusively methyl groups, the only exception being the vinylidene (see above). Reactions of oxidation, chain cleavage, and crosslinking could all take place at these sites. In low-density polyethylenes there are found short chain branches which are generally 3 to 5 carbon atoms long (12). Chain cleavage at these short chain branches could lead to additional crosslinking as well as hydrocarbon evolution in the C_1 to C_5 range.

The various crosslinking reactions suggested would tend to increase the tensile strength (at least to the degree obtained for the total doses investigated). Figure 5, p. 210, shows both chemical and physical changes induced by gamma radiation at various doses out to 1×10^8 r. in 15-mil Alathon. It can be concluded then, that the degrading (loss of properties or usefulness) of this plastic material by gamma radiation in air is caused in part by oxidation reactions where these reactions are *prohibiting* the crosslinking mechanism.

Four thicknesses of Alathon were examined—nominal 3, 5, 10, and 15 mils. The original elongation of each thickness appears to be a function of the film thickness; the thicker the material, the greater the elongation. On the other hand, the tensile strength appeared to be essentially independent of the thickness with the exception of the 10-mil sample which had substantially higher original tensile strength. This was attributed to some variation in processing during manufacture.

The elongation of all the Alathons was reduced as the radiation exposure was increased with

[3] A registered General Electric trademark for irradiated polyethylene.

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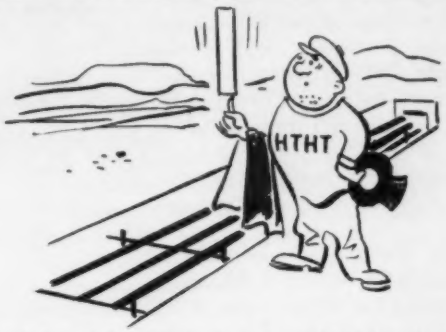

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the greatest rate of decrease occurring between 1 and 5 × 10^7 roentgens. The tensile strength, with the exception of the 15-mil sample, was moderately reduced until an exposure of about 5 × 10^7 r. after which it leveled off and then assumed an upward trend.

The greater decrease shown by the 10-mil material was probably a reflection of its original value which differed considerably from the others. The 15-mil sample on the other hand exhibited a different trend.

Its tensile strength was improved considerably with increased gamma radiation exposure out to a point somewhat beyond 1 × 10^7 r. after which point it assumed the general trend that was found with the other materials.

The instances where the tensile strength and elongation were increased slightly at the low exposures in some of the polyethylenes is attributed to slight variations in the uniformity of the specimens. All materials exhibited a yellow tint after an exposure of 5 × 10^7 r., and became darker with increased exposure.

The 15-mil sample that was irradiated in vacuo out to a dose of 1 × 10^8 r. did not suffer as much damaging change as compared to the air irradiation to the same dose.

The elongation was reduced considerably but not to the extent as in air. The tensile strength, on the other hand, was affected quite differently. The exclusion of oxygen apparently is beneficial with respect to the tensile strength as at the dose in question it had increased slightly.

Marlex polyethylene film: This material is affected quite differently from exposure to gamma radiation than the other ethylenes that were studied.

This is attributed to the high crystallinity, about 95%, of this material which precludes the vinylidene structure and short chain branches. Thus, the crosslinking ability of this resin is greatly reduced. The vinyl unsaturation is found to decrease (even in vacuo) to a negligible amount at a dose of 1 × 10^8 roentgens.

Crosslinking reactions as well as oxidation could be effective in removing this group.

The formation of transvinylene would proceed as in Eq. 2 above. The mass spectrometer analyses indicated large hydrogen evolution again. The lack of higher mass units (C_5 and C_6) being evolved here is attributed to the lack of short chain branches in this linear polymer. The oxidation attack is faster in the Marlex than in the Alathon which would explain the rapid degradation of this polymer in thin films when irradiated in air.

Marlex, which is representative of the so-called linear or high-density types of polyethylene, is characterized by its physical toughness and rigidity as compared with the lower-density materials. As stated previously, it is much more crystalline, about 95% as compared to about 50 percent. This crystallinity apparently is the chief factor that renders this material very susceptible to damage from exposure to ionizing radiation. The material rapidly deteriorated at low exposures and was extremely brittle and crumbly after a dose of 5 × 10^7 r., where it has lost all

(*To page 203*)

Table I: Plastics used for gamma irradiation studies

Material, supplier, and designation[a]	*Type or description and specific gravity*
Carbonates	
General Electric Co.	
Lexan	Polycarbonate resin — 1.20
Naftone, Inc.	
Macrofol	Polycarbonate resin — 1.20
Ethylenes	
DuPont Polychemicals Dept.	
Alathon 3, NC-10[b]	Polyethylene, low-density type, no additives — 0.921
Phillips Chemical Co.	
Marlex 50	Polyethylene, high-density type, no additives — 0.960
General Electric Co.	
U-101	Polyethylene, low-density type, no additives; material used to make Irrathene 101 — 0.920
U-201	Polyethylene, low-density type, contains antioxidant; material used to make Irrathene 201 — 0.920
Irrathene 101	Irradiated polyethylene, low-density type, no additives — 0.920
Irrathene 201	Irradiated polyethylene, low-density type, contains antioxidant — 0.920
Fluorocarbon	
DuPont Polychemicals Dept.	
Teflon 1	Polytetrafluoroethylene, no additives — 2.160
Polyester	
DuPont Film Dept.	
Mylar A	Polyethylene terephthalate, no additives — 1.390
Styrene	
Plax Corp.	
Polyflex	Polystyrene, no additives — 1.050
Vinyl chlorides	
B. F. Goodrich Chemical Co.	
Geon 8630[b]	Polyvinyl chloride, plasticized — 1.340
Geon 8640[b]	Ditto

[a] Registered trademarks by the respective companies for the materials described.
[b] Materials evaluated in more than one thickness (see Table II).

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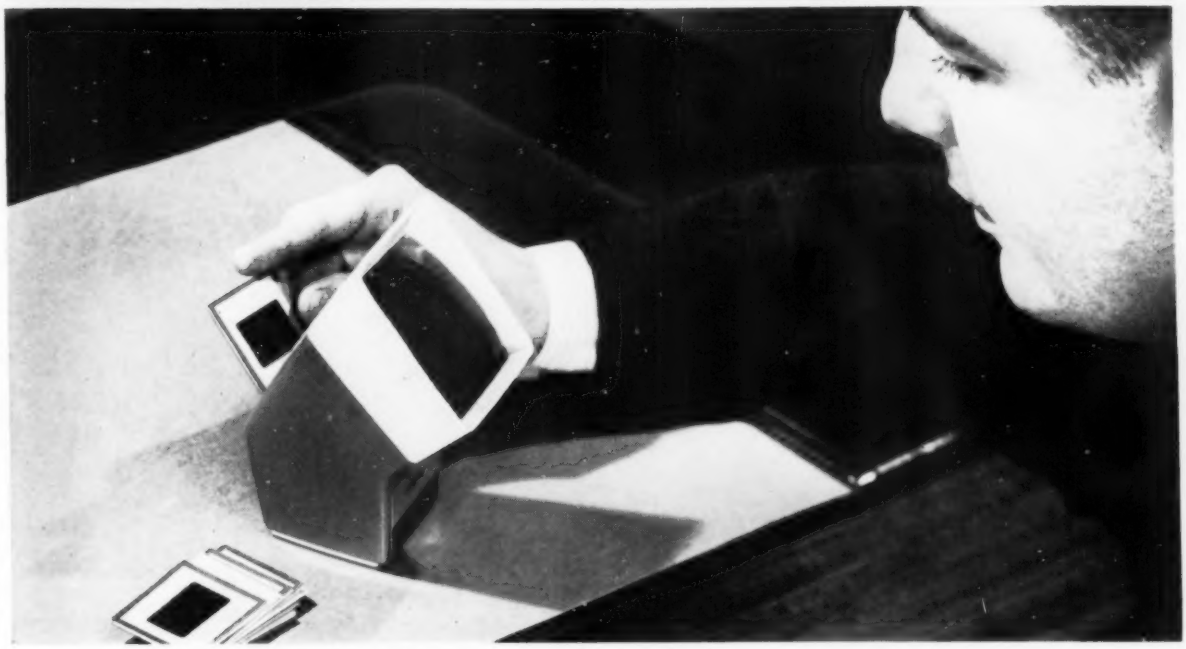

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Table II: Chemical and physical properties of irradiated plastics

Material and thickness	*Dose*	*Physical properties, original and percent change*				*Chemical properties, measured optical densities*					
		Elongation		*Tensile*		*Unsaturation*			*Oxidation*		
	10^6 r.	%	Δ%	p.s.i.	Δ%	*Trans*	*Vinylidene*	*Vinyl*	*Carbonyl*	*Hydroxyl*	*Remarks*
Carbonates											
Lexan (0.003 in.)	0	95		6745		—	—	—	0.903	0.120	a
	5		3.1		14.6	—	—	—	0.917	0.125	
	10		−7.4		−2.1	—	—	—	0.920	0.128	b
	50		−22.7		−0.1	—	—	—	0.915	0.134	c
	100		−33.0		−12.9	—	—	—	0.917	0.142	d
	300		—		—	—	—	—	1.020	0.426	e
Macrofol (0.003 in.)	0	75		6795		—	—	—	0.936	0.059	f
	5		6.5		14.6	—	—	—	0.945	0.064	
	10		0.0		−0.1	—	—	—	0.960	0.070	g
	50		−3.9		−2.1	—	—	—	0.979	0.104	h
	100		−28.6		−12.9	—	—	—	1.000	0.150	h
	100-V*		−22.1		−15.7	—	—	—	0.930	0.151	d
Ethylenes											
Alathon 3, NC-10	0	380		1915		—	0.024	—	—	—	i
(0.003 in.)	5		−3.7		1.1	—	0.019	—	0.040	—	
	10		−7.9		−2.5	0.016	—	—	0.090	—	
	50		−86.8		−33.7	0.027	—	—	0.380	—	j
	100		−95.8		−32.8	0.054	—	—	0.830	—	k
	100-V		−50.0		46.4	0.057	0.013	—	—	—	j
Alathon 3, NC-10	0	510		2330		—	0.047	—	—	—	i
(0.005 in.)	5		5.1		9.8	0.015	0.038	—	0.060	—	
	10		−3.0		−4.2	0.046	0.030	—	0.140	—	
	50		−84.1		−42.5	0.072	—	—	0.720	—	j
	100		−84.9		−42.7	0.127	—	—	1.250	—	k
	100-V		−67.5		8.2	0.140	0.018	—	—	—	j
Alathon 3, NC-10	0	570		2825		—	0.051	—	—	—	i
(0.010 in.)	5		3.0		6.5	0.026	0.042	—	0.070	—	
	10		−3.3		−8.2	0.051	0.034	—	0.130	—	
	50		−81.8		−57.2	0.176	—	—	0.740	—	j
	100		−91.6		−57.7	0.173	—	—	1.350	—	k
	100-V		−65.9		1.6	0.240	0.025	—	—	—	j
Alathon 3, NC-10	0	650		2330		—	0.071	—	—	—	i
(0.015 in.)	5		−10.6		17.8	0.052	0.058	—	0.070	—	
	10		−10.9		22.2	0.088	0.052	—	0.170	—	
	50		−82.7		−42.7	0.285	0.027	—	0.820	—	j
	100		−90.4		−40.2	0.380	—	—	1.500	—	k
	100-V		−73.1		7.1	0.384	0.042	—	—	—	j
Marlex 50	0	600		4280		0.021	—	0.095	0.035	—	i
(0.002 in.)	5		−91.7		−12.7	—	—	0.067	0.060	—	
	10		−97.8		−35.3	—	—	0.055	0.110	—	
	50		−100.		−100.	0.053	—	—	0.438	—	l
	100		—		—	—	—	—	—	—	m
	100-V		−95.3		−7.5	0.092	—	—	—	—	j
U-101 (0.005 in.)	0	535		2180		0.006	0.045	—	0.029	—	i
	5		−0.6		6.4	0.011	0.031	—	0.047	—	
	10		−10.8		−13.4	0.017	0.021	—	0.136	—	
	50		−81.2		−47.4	0.070	0.017	—	0.788	—	j
	100		−96.6		−46.8	0.076	—	—	1.130	—	k
Polyethylene U-201	0	575		1895		0.011	0.054	—	0.039	—	i
(0.005 in.)	5		−5.2		5.0	0.017	0.037	—	0.066	—	
	10		−10.8		−4.2	0.019	0.030	—	0.106	—	
	50		−92.5		−35.3	0.059	0.024	—	0.750	—	j
	100		−96.4		−34.2	0.107	0.014	—	1.010	—	k
Irrathene 101	0	525		2390		0.067	0.045	—	0.052	—	i
(0.010 in.)	5		2.7		9.8	0.083	0.044	—	0.135	—	
	10		−5.2		5.1	0.095	0.043	—	0.215	—	
	50		−68.3		−47.3	0.197	0.036	—	0.755	—	j
	100		−94.4		−44.4	0.212	0.032	—	1.168	—	k
	100-V		−64.8		11.4	0.307	0.028	—	—	—	j
Irrathene 201	0	595		2405		0.068	0.045	—	0.058	—	n
(0.010 in.)	5		−6.2		13.4	0.078	0.039	—	0.090	—	
	10		−9.4		2.9	0.097	0.035	—	0.171	—	
	50		−69.8		−46.7	0.162	0.036	—	0.635	—	j
	100		−94.5		−46.3	0.209	0.027	—	0.863	—	k

(Continued on opposite page)

Table II: Chemical and physical properties of irradiated plastics (Continued)

Material and thickness	*Dose*	*Physical properties, original and percent change*				*Remarks*
		Elongation		*Tensile*		
	10^6 *r.*	%	Δ%	*p.s.i.*	Δ%	
Fluorocarbon						
Teflon 1 (0.010 in.)	0	165		2695		i
	.1		−9.1		−44.6	
	.5		−78.8		−54.8	
	1		−87.0		−59.2	
	5		−100.0		−61.1	e
	5-V		−78.8		−47.7	
Polyester						
Mylar A (0.003 in.)	0	150		20,340		o
	5		0.0		0.0	
	10		−13.3		−6.4	
	50		−20.0		−15.6	
	100		−30.3		−34.1	
	100-V		−23.3		−22.8	
Styrene						
Polyflex (0.002 in.)	0	0		11,270		o
	5		—		−6.4	
	22		—		−15.9	
	55		—		−13.4	
	100		—		−23.2	j
	100-V		—		−25.5	
Vinyl chlorides						
Geon 8630	0	245		2555		p
(0.004 in.)	5		−10.7		−25.6	q
	10		−21.3		−34.5	r
	50		−26.5		−36.2	s
	100		−38.8		−31.5	t
Geon 8630	0	300		2735		p
(0.020 in.)	5		4.0		−5.7	q
	10		4.6		−6.2	r
	50		−19.2		−10.2	s
	100		−28.3		−6.0	t
Geon 8640	0	225		3150		o
(0.004 in.)	5		−8.5		−13.3	u
	10		−11.8		−28.1	v
	50		−44.4		−44.4	w
	100		−46.7		−42.3	x
	100-V		−29.1		−22.4	w
Geon 8640	0	325		3580		o
(0.020 in.)	5		−5.3		−5.1	u
	10		−2.2		−4.1	v
	50		−22.2		−32.0	w
	100		−32.3		−31.2	x

*V-Irradiated in vacuo.
a - Light tan transparent.
b - Light yellow.
c - Light amber.
d - Slightly darker amber.
e - Very brittle; broke on bend test; could not test.
f - Light amber transparent.
g - Very slightly darker amber.
h - Darker amber.
i - Off-white translucent.
j - Light yellow tint.
k - Slightly darker yellow.
l - Quite brittle; broke on bend test.
m - Crumbled; could not test.
n - Off-white; slight yellow tint.
o - Clear transparent.
p - Transparent; slight cloudiness.
q - Light tan translucent.
r - Light orange translucent.
s - Dark brown opaque.
t - Darker brown opaque.
u - Very light orange transparent.
v - Light orange-tan transparent.
w - Dark brown-orange transparent.
x - Dark brown-amber; slightly transparent.

of its tensile strength and elongation. Exclusion of air helped considerably as the material was not brittle after being irradiated in vacuo to 1×10^5 roentgens. Here it had lost most of its elongation, yellowed slightly, but retained a substantial amount of its tensile strength. In thicker films, this material is not nearly as drastically damaged and behaves more in the manner that is exhibited by the lower density polyethylenes.

Irrathene,[3] irradiated polyethylenes: U-101 and U-201 are designations assigned to the polyethylene materials which were electron irradiated to produce the Irrathene[3] 101 and 201 materials, respectively. The 201's differ only in that they contain small amounts of an antioxidant. The Irrathene[3] samples before gamma irradiation have more transvinylene and less vinylidene than the U-101 and U-201 after correcting for thickness differences. The chemical reactions taking place such as crosslinking, oxidation, etc. would be similar to those suggested for Alathon.

Table II shows that radiation-induced oxidation in the 201's, as determined by carbonyl formation, is less than that for the 101's. This is attributed to the effectiveness of the antioxidant. This difference is not reflected in the physical property changes of these materials which, within the experimental error of the measurements, changed to about the same extent. The 10-mil films of Alathon and Irrathene[3] 101 showed about the same decrease in elongation when irradiated in vacuum while the tensile strength of Irrathene[3] increased slightly more under these conditions.

The degree that oxidation affects the physical properties depends also on the effects of other competing reactions. In general, the U-101 and U-201 oxidize more than the Irrathene[3] 101 and 201, respectively, showing that the crosslinking which had taken place from the original electron irradiation (during process of manufacture) has made the material more stable to oxidation attack. The magnitude of these two effects, initial crosslinking and presence of an antioxidant,

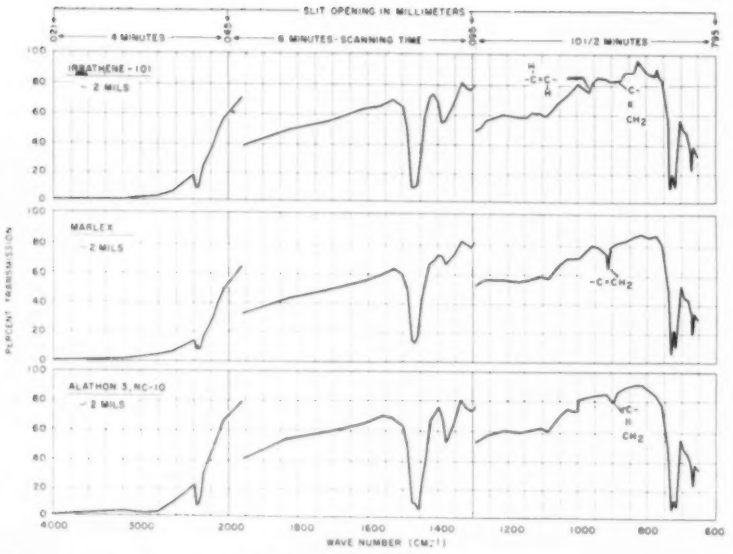


Fig. 4: Original spectra of polyethylenes

are approximately equal on oxidation resistance.

The vinylidene group decreases rapidly at first and then slowly to doses of 5×10^7 and 1×10^8 roentgens. It is probable here that surface oxidation, with some penetration, is active in removing this group to a greater extent than the crosslinking reactions. The oxidation attack was lessened at higher doses because of a "protective" layer of oxide being formed. It is noted that the rate of formation of carbonyl is tending toward saturation at the higher doses. This effect is contrary to that in Alathon. The crystallinity, molecular weight variations, and or initial crosslinking may account for these differences.

The 725 cm.$^{-1}$ band in polyethylene has been assigned to $-CH_2-$ rocking mode (13). This band has been observed to split into two components (in solids) at 731 and 721 cm.$^{-1}$ (6,14,15). The 731 cm.$^{-1}$ band has generally been assigned to a vibration in the crystalline part of the material. Keller and Sandeman (14) have further stated that the 721 cm.$^{-1}$ band arises from both amorphous and crystalline phase vibrations. This interpretation is satisfactory for the original spectra of the four polyethylenes as indicated above. Upon irradiating the Irrathene[3] 101 and U-101 a decrease in the 721 cm.$^{-1}$ band is observed in 2-mil films. According to the above assignments, a decrease in amorphous content, or more specifically of the $-CH_2-$ rocking mode in the amorphous areas, of the samples would be responsible. It does not seem reasonable to imply that gamma radiation would produce a more ordered polymer unless one could consider a three-dimensional network chain, produced by crosslinking, as a more crystalline material. It appears that more complicated factors are occurring and further experimental work will be done on this problem.

The mass spectrometer results indicate further differences in the ethylene polymers. Figure 6, p. 212, shows the mass spectral cleavage pattern in all of these materials studied. The C_nH_x mass is not found and the amount of C_5H_x is considerably smaller for the Irrathene[3] 101 as compared to the Alathon. There is a larger amount of CH_4 and C_2H_x evolved from the Irrathene.[3] The first effect is explained by the initial crosslinking of the short chain branches (4 to 6 carbon atoms long) during the manufacture or processing of polyethylene into Irrathene.[3] The increased evolution of methane and ethane/ethylene is harder to account for, but must again be tied in with the crosslinking of the material initially.

With respect to physical property changes induced in the Irrathene[3] by exposure to gamma radiation, the elongation followed the same pattern as exhibited in the Alathons. The tensile strength also showed the same trend as shown by the Alathons except that at the first exposure of 5×10^6 r. the tensile strength appeared to be increased to a slightly greater extent. This could be attributed to both the fact that the initial electron irradiation processing caused this, and the fact that the nominal 10-mil Irrathene[3] films were approximately 11 mils whereas the Alathon was about 9 mils. This latter fact might contribute more as the thickness is approaching that of the Alathon 15-mil material whose tensile strength was increased considerably at the first exposure.

All of the Irrathenes[3] became slightly yellow at a dose of 5×10^7 r. and became darker on continued exposure. No detailed discussion is given to the U-101 and U-201 materials which were

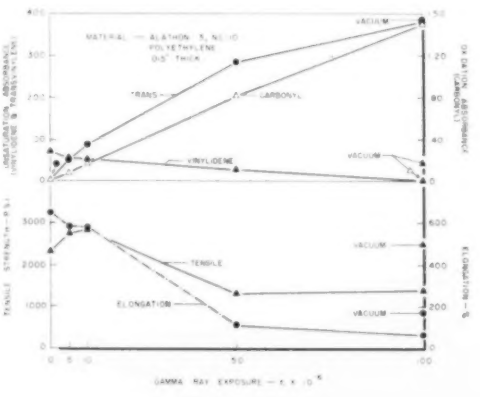
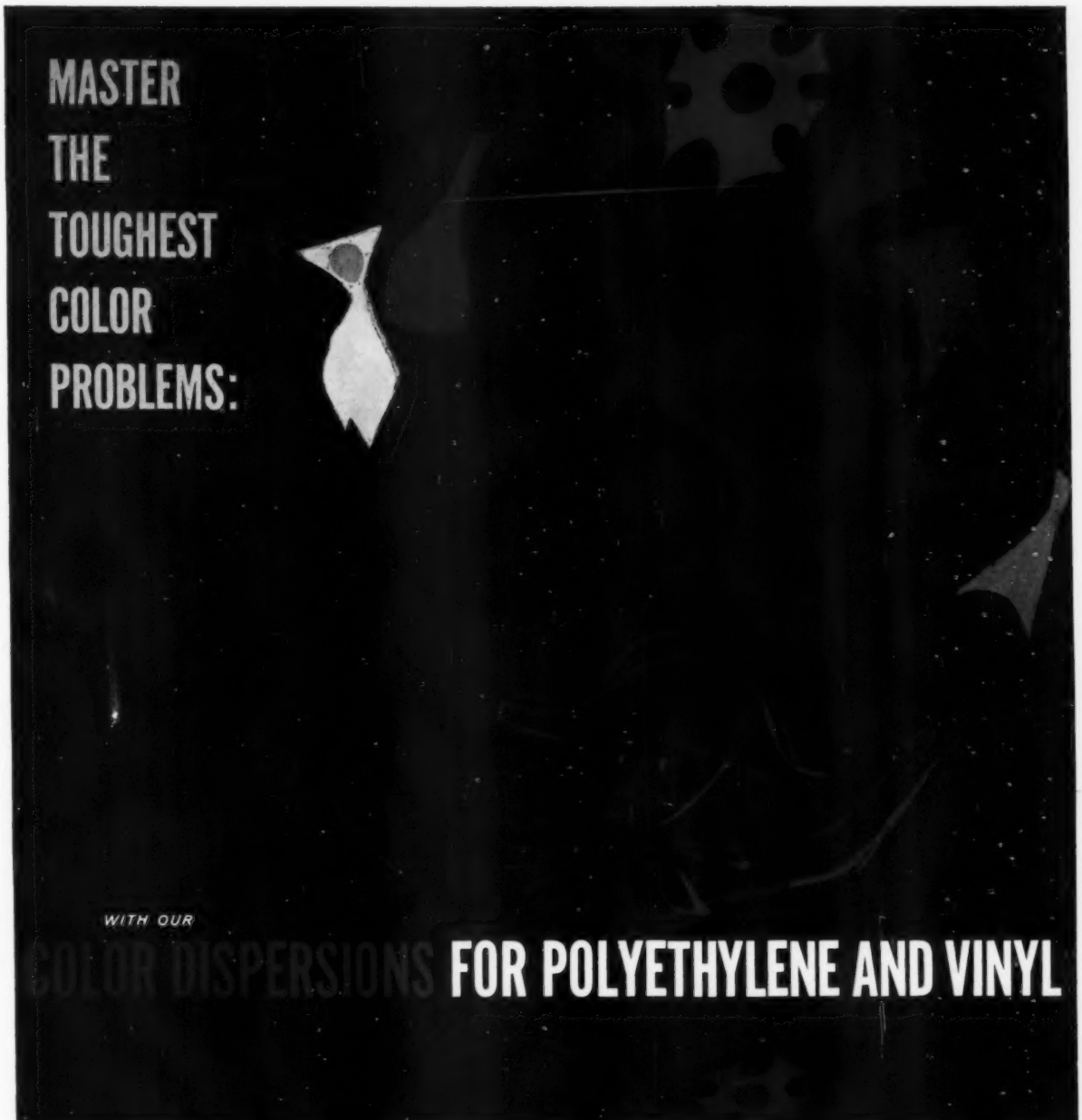


Fig. 5: Chemical and physical changes in polyethylene plastic induced by exposure to gamma radiation at 25° C.



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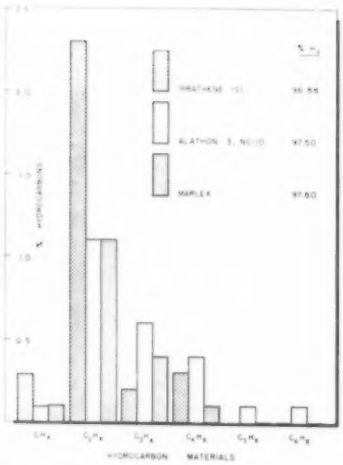

Fig. 6: The mass spectral cleavage pattern for polyethylene plastics

representative of the polymers from which the Irrathenes[3] were made. They were the same general type as the Alathons and behaved in essentially the same manner.

Fluorocarbon

Teflon 1 polytetrafluoroethylene was used here as being representative of a fluorocarbon plastic. Ryan (15) has given an empirical formula for the evolution of fluorine from Teflon, as follows:

$$X = 3.78 \times 10^{-7} Y^{1.151} \qquad \text{Eq. 5}$$

where X equals micrograms of fluorine gas liberated per gram of Teflon irradiated to a gamma dose of Y roentgens. The vacuum irradiation of Teflon did not evolve sufficient gas to be measured by the mass spectrometer. This situation could possibly have been due to absorption or reaction of fluorine with the glass container.

The total moles evolved (assuming all fluorine gas) was considerably smaller than the above equation indicates. This is probably because Eq. 5 was based on irradiations carried out under sodium hydroxide solution and in the present case no effort was made to keep fluorine from reacting with the glass vessel. The possibility of fluorocarbon evolution can not, however, be completely ruled out.

Ryan (15) assigned bands at 1754 and 1538 cm.$^{-1}$ to $-CF=CF-$ and $-CF=CF_2$, respectively, observing these after irradiations to 1×10^8 roentgens. In the present work no changes were found in 10-mil films for these bands to an exposure of 5×10^6 roentgens. At this dose Teflon had become severely damaged, having lost all of its elongation and about 60% of its original tensile strength. Figure 7, p. 214, graphically illustrates how the physical properties of Teflon are affected by exposure to gamma radiation. After being exposed to 5×10^6 r., Teflon was quite brittle and failed in the 180° bend test.

It can be seen that low doses of radiation greatly affect the physical properties of Teflon. Whether or not these large physical property changes were caused by either small or large structural changes in Teflon has not been established here. However, the work reported here seems to agree with the conclusions of Ryan (15), who found that the breaking of one in 1000 C-F bonds results in major physical property changes.

Polyester

Tobin (16) has recently published assignments for the bands found in Mylar A polyester (polyethylene terephthalate). There were no changes in the infra-red spectrum after irradiating this material to a dose of 1×10^8 r. in the present work, and there was insufficient gas evolution for mass spectrometer analysis. The benzene ring along the main chain, because of its resonance stability, contributes significantly to the radiation resistance of this material. At some higher exposure a degradation of the polymer would undoubtedly occur.

Figure 8, p. 214, shows how the physical properties of Mylar are affected by exposure to ionizing radiation. The tensile strength and elongation were reduced with increased radiation dose at about equal rates. At the highest exposure studied, 1×10^8 r., the material retained a substantial amount of both physical toughness and flexibility. The irradiation in vacuo to 1×10^8 r. did not change this material much more than the irradiation in air to a dose of 5×10^7 roentgens. This indicates that oxidation plays at least some part in the damage induced in this material.

Styrene

The thermal degradation of polystyrene has been studied using infra-red techniques by Achhammer et al. (17). They give reactions for crosslinking, hyperoxide formation, etc. At a total dose of 1×10^8 r. no changes were observed in the infra-red spectrum of Polyflex polystyrene and there was no indication of gas evolution from the specimens irradiated in vacuo to 1×10^8 roentgens.

As this material had zero initial elongation, only tensile strength was evaluated. It behaved almost precisely in the same fashion as did Mylar polyester—a gradual lowering with increased radiation exposure. This tensile strength behavior is graphically illustrated in Fig. 8, along with the behavior of Mylar. At a dose of 1×10^8 r. the material appeared to be substantially unchanged from its original condition with the exception of a slight yellowing and loss of tensile strength. In vacuo to 1×10^8 r., the material appeared to be slightly more dam-

Table III: Chemical effects and absorption frequencies

Type	*Absorbing group*	*Frequency cm.$^{-1}$*
Unsaturation		
Transvinylene	H –C=C– H	965
Vinylidene	–C– ‖ H–C–H	888
Vinyl	H –C=C H H	909
Oxidation		
Carbonyl	C=O	~1720
Hydroxyl	O–H	~3550

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aged with respect to tensile strength reduction than it was in air at the same dose. This indicates that oxidation plays little or no part in the radiation-induced damage to polystyrene. The benzene ring structure is again given credit for the radiation stability of this material.

Vinyl chlorides

The two Geon polyvinyl chloride materials used in these studies contained plasticizer which gave rise to an intense carbonyl absorption band at about 1720 $cm.^{-1}$. The presence of this band in the specimens masked any oxidation effects which might have occurred. The mass spectrometer results, which are given in Table IV, show a large amount of carbon dioxide evolved which must have come from the plasticizers. There was also hydrocarbon evolution in the C_2 to C_6 range, typical of vinyl type polymers. There was found larger amounts of methane (6.6%) which was probably evolved from the plasticizers also. Significantly, no chlorine or chlorohydrocarbon gases were found, showing that little or no reaction took place in the main polymer chain.

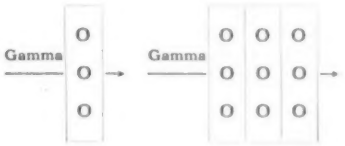
In contrast to the chemical changes in the Geon which were not readily identifiable, physical property changes were quite pronounced. Figure 9, p. 217, graphically shows physical property changes in Geon 8640 4-mil material as a function of radiation exposure. All of the Geon samples exhibited a gradual decrease in tensile strength to a dose of 5×10^7 r., after which it began to increase. Geon 8630 in the 20-mil thickness exhibited less decrease than did the others. The decrease followed by an increase suggests that chain cleavage occurs initially after which cross-linking predominates. With the exception of the Geon 8630 20-mil sample which showed a slight increase in elongation before assuming a downward trend, these materials decreased in elongation with increased radiation exposure. The Geon 8640 4-mil material that was irradiated in vacuo to 1×10^8 r. was less damaged than its counterpart irradiated to the same dose in air. This establishes the fact that oxidation plays an important role in the radiation induced damage to polyvinyl chloride. As noted in Table II the materials were very much discolored with increased radiation dose.

Effect of sample thickness in polyethylene

As was stated previously and as noted in Table II, radiation-induced changes in polyethylene are also a function of sample thickness. This effect of specimen thickness was studied using Alathon 3, NC-10 as being representative of a typical polyethylene. Primary changes that were noted were in carbonyl and in transvinylene.

Oxidation: The plot of log (T_o/T) (optical density) versus L (thickness), which is shown in Fig. 10, p. 217, for the carbonyl absorption in Alathon, indicates that oxygen is penetrating into the specimens in amounts that may be quite significant in thinner films. Ballentine et al (18) have stated that oxidation would be a surface effect, and unsaturation by ionizing radiation would be independent of the bulk. This would be expected to hold true for oxidation of films where the surface to volume ratio was small. The actual distribution of oxygen (in this case carbonyl) in the sample depends upon at least two factors: 1) the availability of reaction sites with which oxygen may combine, and 2) the kinetics of oxygen diffusion and carbonyl formation rate.

Consider, for example, two samples of homogeneous composition varying only in thickness (L) receiving the same gamma radiation. We have then



where "O" represents reaction sites (free radicals, excited atoms, ions, etc.) created by the ionizing radiation. The function of thickness is just to increase the number of these sites, but the number per unit volume remains the same. The effect of increasing the gamma dose is only to in-

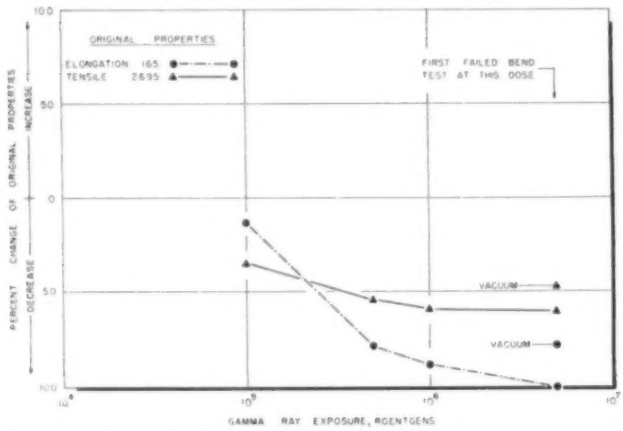


Fig. 7: Change in the properties of Teflon polytetrafluoroethylene induced by exposure to the gamma radiation in the air at 25° C.

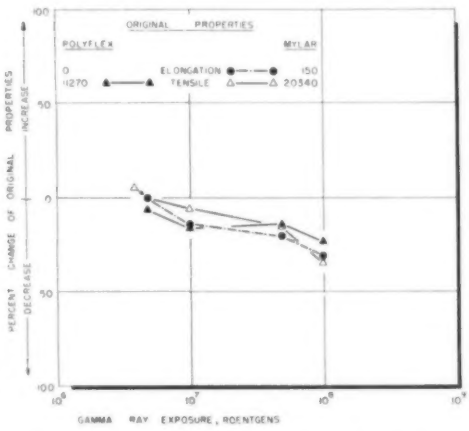


Fig. 8: Change in properties of polystyrene and polyester plastics induced by the exposure to gamma radiation in the air at 25° C.

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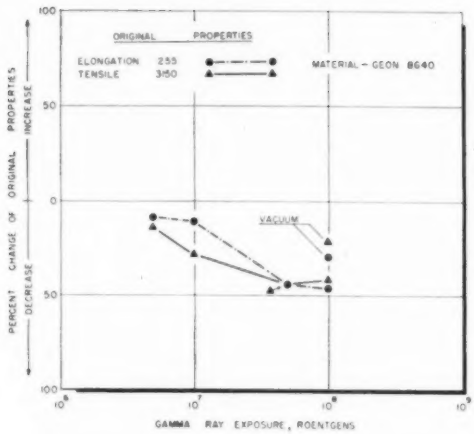


Fig. 9: Change in properties of plasticized polyvinyl chloride which is induced by exposure to gamma radiation in the air at 25° C.

crease the number of sites produced per unit volume. The sites "O" react in a number of ways: oxidation, crosslinking, recombination, etc. It is reasonable to assume that of the total number of sites available, the number that *could* produce carbonyl formation would be homogeneously distributed in the samples prior to any reactions taking place. The total oxidation absorbance would seem then to more strongly depend on the kinetics of oxygen diffusion.

To show how chemical effects vary with sample thickness and radiation dose, a function Q (called here the "chemical effects function") is derived (see Appendix, p. 221). It is defined as follows:

$$Q = \frac{\log (T_0/T)}{(L)\,(Mr)} \qquad \text{Eq. 5}$$

Figure 11, below, shows a plot of Q versus L. This curve shows that carbonyl absorption should change linearly with the radiation dose. The curve is useful in determining absorbance values at a particular thickness and has been used here to plot the curves in Fig. 10 on which the experimental points are plotted, and in Fig. 12, p. 220, log (T_0/T) vs. Mr. (millions of roentgens or megaroentgens). From Eq. 6 the relationship between thickness and oxidation has been derived (see Appendix) and is as follows:

$$\frac{L}{A} = BL + C \qquad \text{Eq. 7}$$

Figure 13, p. 220, is a plot of A vs. L compared with two curves from Fig. 10. Equation 7 is valuable for extrapolation of data. It adequately predicts zero carbonyl absorbance at zero thickness and also a limiting value for the absorbance as the oxidation is increased. This limiting value is equal to $1/B$.

Unsaturation: The unsaturation increase in polyethylene as illustrated by Eq. 2 is transvinylene (7,8). This type of bond formation ultimately requires hydrogen abstraction from adjacent carbon atoms. The reaction mechanisms necessary should be possible in any part of the sample, especially assuming a homogeneous composition. The reaction would further depend on the sample thickness if it was sufficiently large to reduce the probability of hydrogen molecules escaping.

Figure 14, p. 221, shows the increase in transvinylene formation as a function of thickness. The changes in this property with radiation exposure are shown in Fig. 15, p. 221. The tendency to saturate at higher exposures is evident. These curves are analogous in shape to the oxidation of polyethylene as a function of thickness, and in fact, an equation of the form of Eq. 7 can be derived by replacing L with Mr. The result is not quite as accurate as in the case of oxidation.

The vinylidene unsaturation decreases. Figure 16, p. 221, shows the effect of thickness on this property; an approximate linear variation is indicated. However, because of the competing reac-

(*To page* 220)

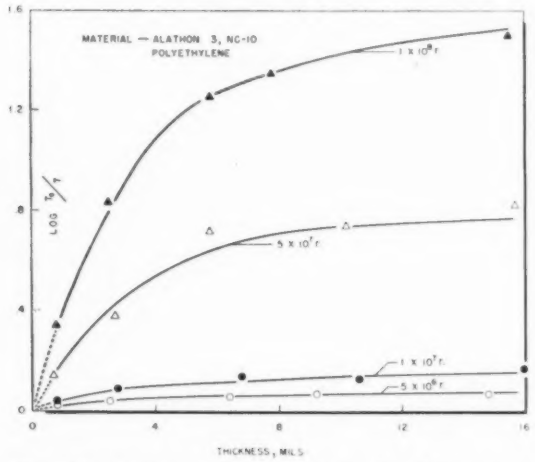


Fig. 10: Oxidation of polyethylene plotted as a function of thickness of the material

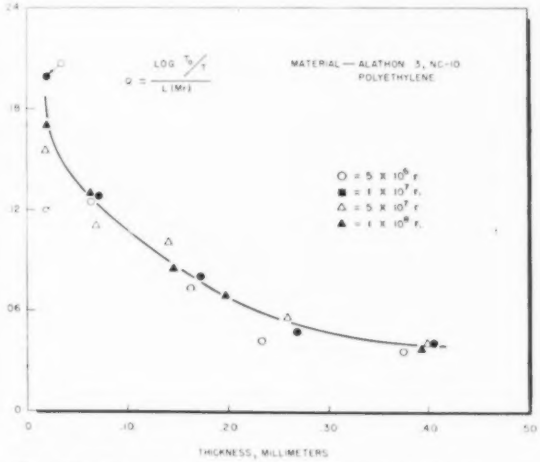
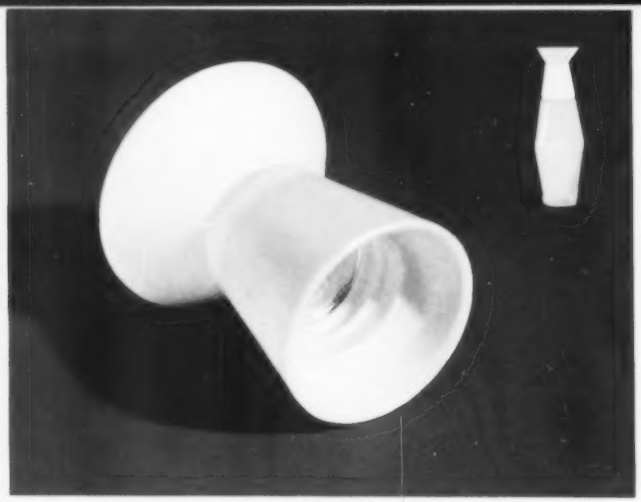
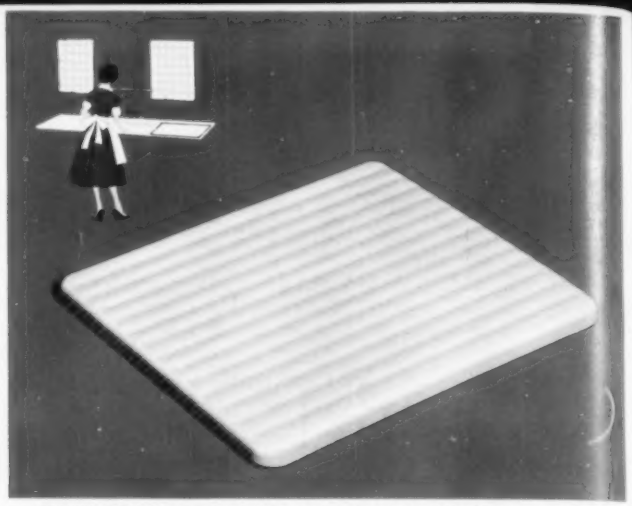


Fig. 11: Chemical effects function versus thickness for oxidation of polyethylene plastic



CLOSURE MOLDED OF UREA. This is a double reverse taper closure for Max Factor's Hypnotique Parfum-Cologne. Urea molds readily, and various types are available to meet individual job requirements and plasticities.



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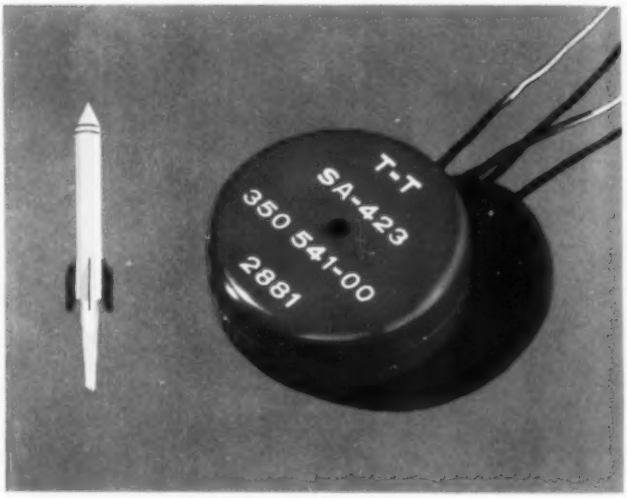
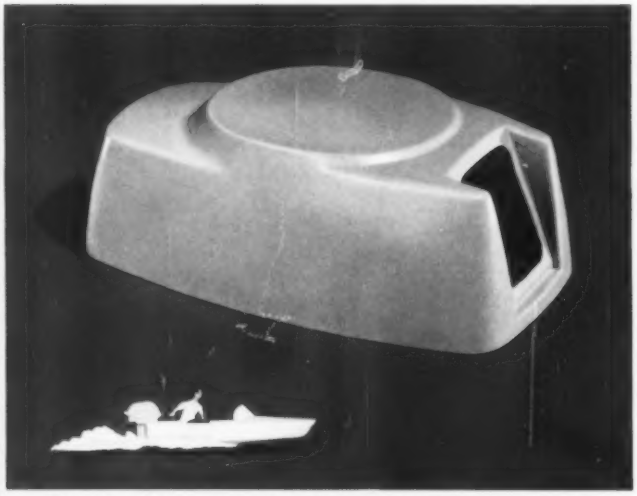


TORROID COIL ENCASED IN ALKYD. This coil is encased in alkyd putty material to prevent changes in electrical value of the component. In addition to alkyd's remarkable electrical properties, it molds at very low pressures allowing encasing of delicate inserts without damage.



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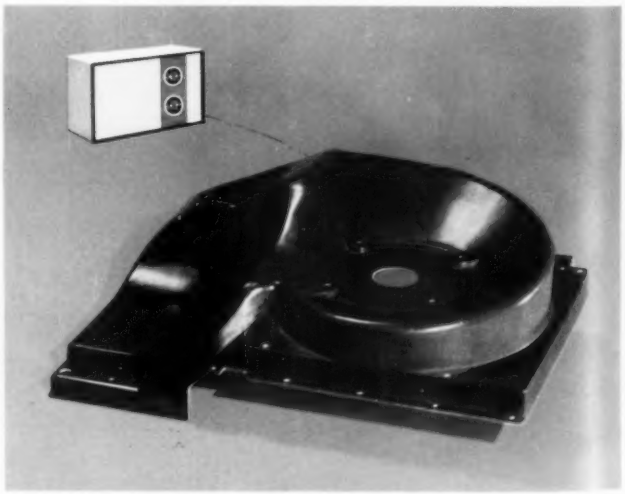

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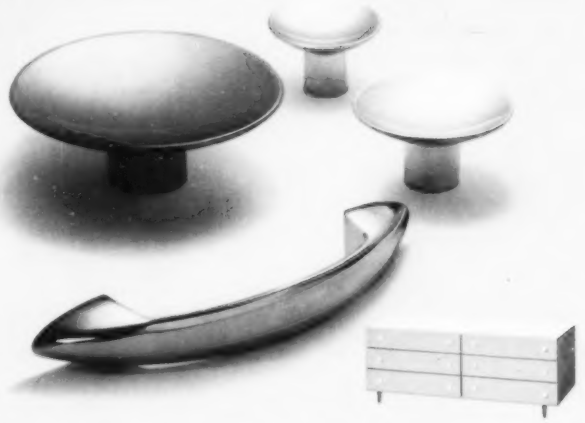
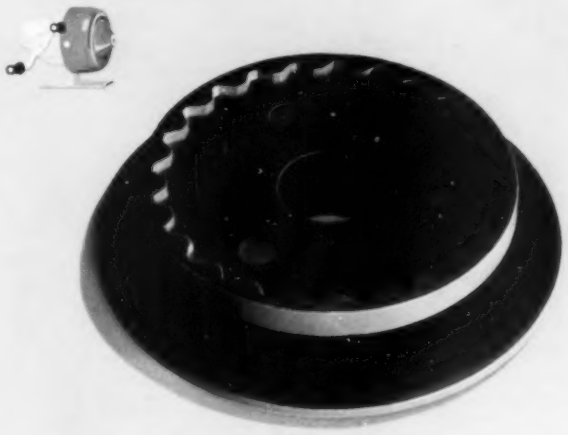


DRAW PULLS MOLDED OF NYLON. Knobs and handles, injection-molded by Mirra-Cote, are metalized for lasting brilliance. The low-molding temperature of PLASKON Nylon minimizes thermal degradation and resultant gas evolution—produces void-free moldings. This nylon also provides excellent dimensional stability for critical tolerance parts.



REEL SPOOL OF MOLDED REINFORCED ALKYD. Glass reinforced alkyd easily withstands the tremendous pressure of wound nylon line during drying on this reel by Bronson Co. Alkyd offers very low mold shrinkage, excellent dimensional stability, low pressure and high-speed molding.

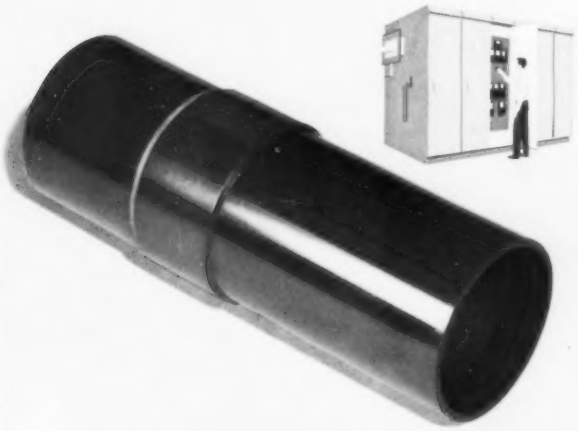


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Table IV: Gas evolution from plastics irradiated in vacuo to 1×10^8 roentgens

Materials	*Gas evolved*									*Remarks*
	H_2	CH_4	C_2H_x	O_2	C_3H_x	CO_2	C_4H_x	C_5H_x	C_6H_x	
Macrofol	%	%	%	%	%	%	%	%	%	a
Alathon 3, NC-10	97.5	0.09	1.10	0.01	0.60	—	0.40	0.10	0.10	
Marlex 50	97.8	0.10	1.10	0.20	0.40	—	0.10	—	—	b
Irrathene 101	96.9	0.28	2.30	0.01	0.20	—	0.30	0.10	—	
Teflon 1	—	—	—	—	—	—	—	—	—	c, d
Mylar A	—	—	—	—	—	—	—	—	—	e
Polyflex	—	—	—	—	—	—	—	—	—	f
Geon 8640	46.0	6.60	4.00	0.25	2.60	34.00	3.00	1.00	2.00	

a - Less than 3.2×10^{-4} moles per gram evolved at standard temperature and pressure.
b - 0.3% N_2 found due to incomplete vacuum.
c - Total dose was 5×10^6 roentgens.
d - Less than 3.9×10^{-3} moles per gram evolved at standard temperature and pressure.
e - Less than 2.1×10^{-4} moles per gram evolved at standard temperature and pressure.
f - Less than 4.2×10^{-4} moles per gram evolved at standard temperature and pressure.

tions affecting this group (oxidation and crosslinking) and their dependence (especially oxidation) on the thickness of the material, no simple relationship can be assumed here.

Summary and conclusions

For those materials that are susceptible to radiation-induced oxidation, it has been found that the specimen thickness plays an important role in the extent of both chemical and physical property changes caused by exposure to ionizing radiation. This is because the chemical effects and resulting physical property changes caused by oxidation are a function of the total amount of oxidation of the materials and its distribution within them. The increase in carbonyl with sample thickness does not follow a surface-to-volume ratio until the samples exceed about 30 mils.

A function Q, called the chemical effects function, has been derived as a consequence of the above thickness dependency of oxidation. This function is useful to extrapolate data and correct for thickness differences.

Irradiating the plastics in vacuo, although eliminating the effects caused by oxidation, does not necessarily prevent changes from occurring. This is because other effects such as crosslinking which are often obscured by oxidation now manifest themselves. For example, it has been found that oxidation inhibits crosslinking in polyethylene.

In the polyethylenes studied, oxidation is much more pronounced in the linear or high-density materials than in the lower-density types as evidenced by a drastic reduction of both tensile strength and elongation. On the other hand, the low-density materials which were processed by electron irradiation oxidize at a slower rate when subjected to gamma radiation because they were somewhat crosslinked during processing. The differences in effects between the high- and low-density polyethylenes can be attributed to differences in crystallinity.

At exposures up to 1×10^8 r. a good correlation between chemical and physical property changes is not always possible. This is

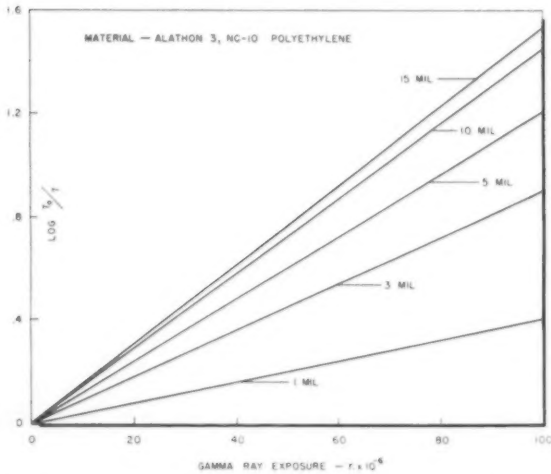

Fig. 12: Oxidation of polyethylene as a function of the gamma radiation exposure

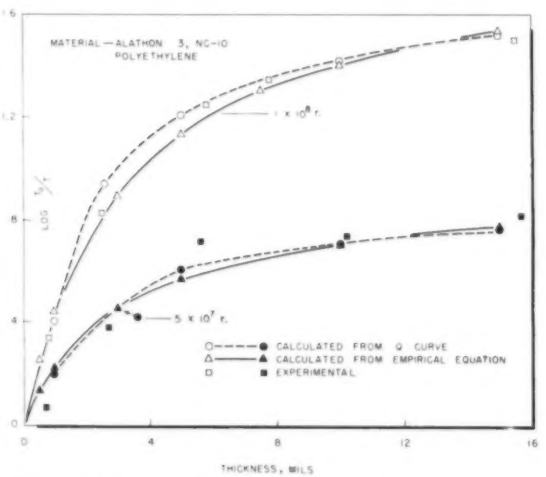

Fig. 13: Calculated and experimental carbonyl absorption in polyethylene

because incipient and small chemical changes which are not detectable by infra-red and/or mass spectrometer analyses can lead to either small or large physical property changes which are observable. In the instances when both chemical and physical property changes can be observed, a good correlation or relationship can be obtained. Here both methods of evaluation serve to supplement each other to explain the ultimate changes that are induced in plastics by ionizing gamma radiation.

Appendix

Derivation of chemical effects function Q: The function Q, which is proportional to the radiation efficiency (as shown below) has been defined to eliminate the need of determining specific absorption coefficients for the carbonyl groups. These are difficult to determine because acid, ketone, and aldehyde groups are all contributing to the intensity of the absorbance and the resolution of the prism spectrometer is not sufficient to determine the individual contributions. Each of these groups contributing to the band would be formed in the same ratio, independent of total exposure and thickness.

The weight fraction of a functional group is given by (11):

$$\text{Weight fraction} = \frac{\log (T_0/T)}{(P)\,(K_{0.1}{}^{-})\,(L)\,(10)}$$

where T is the percent transmission of light (at about 1720 cm^{-1}) through the sample, T_0 is the background transmission which has been corrected to 100%, P is the density in g./$cm.^3$, $K_{0.1}{}^{-}$ is the specific absorption coefficient in $cm.^2$/g. for a 0.1 mm. sample cell, and L is the thickness in millimeters.

The above equation assumes Beer's Law to hold. Rugg et al. (5) have demonstrated this in 30-mil films of polyethylene with up to 0.1% by weight C=O. It is probable that the concentration of carbonyl in the irradiated films is higher than this but the assumption will still be made.

The radiation efficiency G

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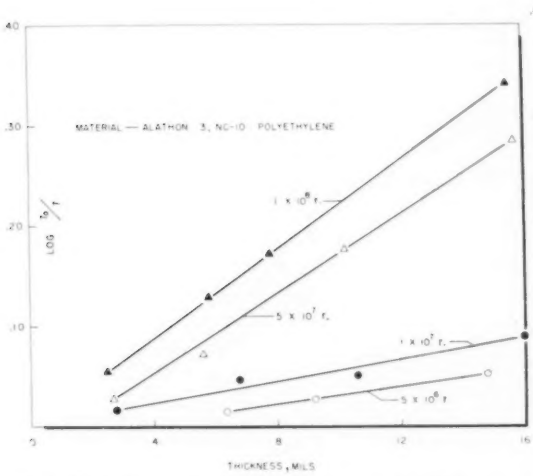

Fig. 14: Increase in transvinylene in polyethylene with increasing thickness

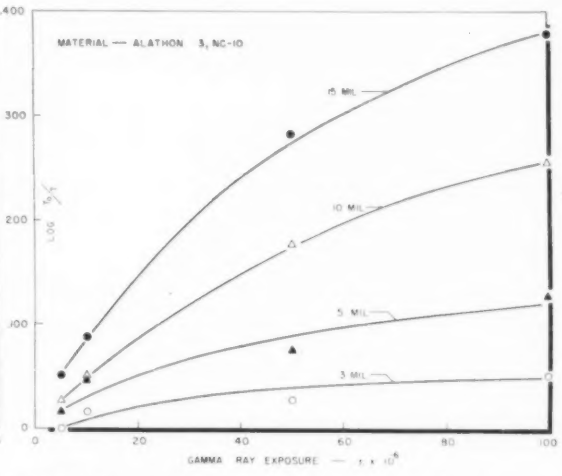

Fig. 15: Increase in transvinylene in polyethylene with increasing radiation dose

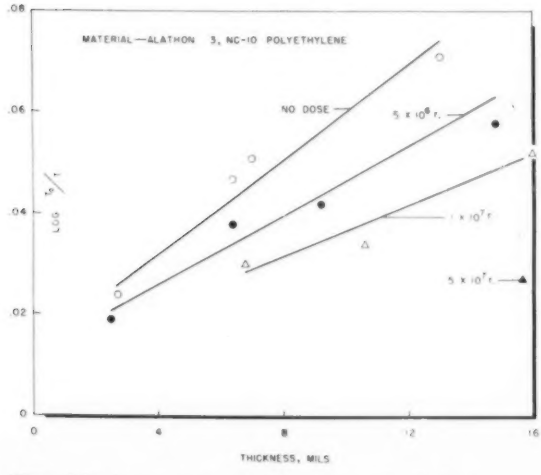

Fig. 16: Increase in vinylidene in polyethylene with increasing thickness

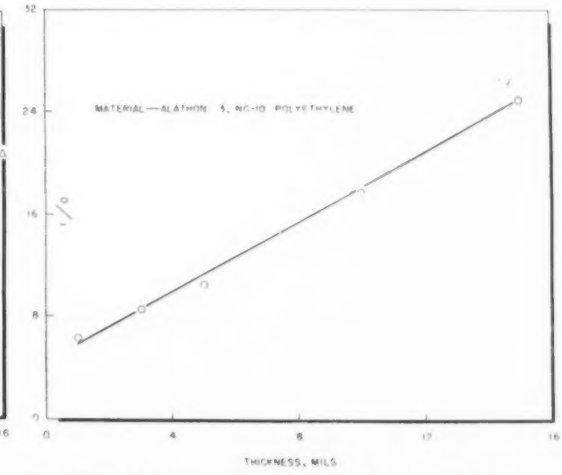

Fig. 17: Linear nature of 1/Q as a function of the thickness of polyethylene material

Rapid determination of moisture capacity, diffusion coefficient, and activation energy in Plastics laminates

By J. W. Rowen and R. K. Laudenslager**

A study has been made of three possible procedures for the determination of the sorption characteristics of plastic laminates. It was not possible to find a rate equation which would fit equally well over the entire time scale. The failure ruled out the possibility of accurately evaluating the equilibrium moisture capacity (Q_∞) and the diffusion coefficient (D) by the fitting of the integrated diffusion equation with data involving small time values.

When diffusion was accelerated by suitable temperature elevation, it was possible to evaluate Q_∞ and D from the data obtained. Subsequent study showed the equilibrium moisture capacity to be relatively independent of temperature and the diffusion coefficient to be markedly temperature dependent. The activation energy of the diffusion process varied from 7,000 to 17,200 calories for glass fabric laminates made with five common thermosetting resins.

The accelerated measurement and extrapolation procedure is presented in six steps. The necessary moisture sorption-diffusion quantities may now be obtained in one week instead of one year.

The approach of moisture sorption to equilibrium in plastic laminates at room temperature is a slow process (1)[1] requiring thousands of hours (Fig. 1, below). The intrinsic slowness of the process makes it extremely difficult to evaluate the effects of parameters such as composition, molding times, and temperature upon the sorption process. A rapid method is therefore needed for the characterization of the moisture sorption process at ordinary environmental temperatures and vapor pressures. We have studied the process and developed a simple, rapid method for determining these quantities. Its application to five laminates made of glass fabric and thermosetting resin is described in this report.

Materials

Laminated panels were made from commercially available resin and glass fabric (181-Volan A). The molding and curing conditions employed are summarized in Table I, p. 223. From these panels sample disks 2.1340 in. in diameter and 18 plies (0.1400 in.) thick were cut. The disks were dried to constant weight in a vacuum oven at 150° C. Distilled water and standard salt solutions were used in conditioning the samples at 22, 50, 70, and 98% relative humidity. The atmosphere over these solutions was checked from time to time with a psychrometer and an Aminco-Dunmore humidity gage. Duplicate specimens were used for comparison of weight increases.

The three quantities (2), equilibrium moisture capacity (Q_∞), diffusion coefficient (D), and activation energy (E), completely characterize the sorption process and bear certain mathematical relationships to each other which are summarized here.

Each ply of a laminate may be regarded as a lamina of thickness L across which there is a moisture gradient. If the lamina area A contains a quantity G of vapor being transferred in unit time t a distance X at a concentration C, then (3)

$$G = DA \frac{dC}{dX} \qquad \text{Eq. 1}$$

and

$$\frac{dC}{dt} = D \frac{d^2C}{dX^2} \qquad \text{Eq. 2}$$

where D is the diffusion coefficient and C the concentration. C is related to the experimentally observable quantity Q, the total amount of vapor absorbed at time t, by

$$Q = A \int_0^L C \, dX \qquad \text{Eq. 3}$$

with the boundary condition that $Q = ALC$ at equilibrium.

The solution of Eq. 2 must satisfy the conditions expressed in the following equations:

$$C = F(X, t) \text{ when } t > 0 \qquad \text{Eq. 4}$$

$$C = f(X) \text{ when } t = 0 \qquad \text{Eq. 5}$$

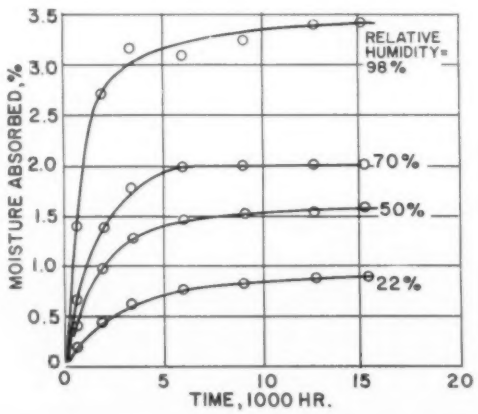

Fig. 1: Moisture absorption of a phenolic-glass laminate at 25° F.

*Hughes Aircraft Co., Culver City, Calif.
[1]Numbers in parentheses link to references at end of article, p. 224.

For the case in which the lamina has parallel and infinite plane boundaries, the solution (4, 5, 6) of Eq. 2 is

$$Q = Q_\infty + \frac{2AC}{\pi} \int_0^L \sum \left(\frac{\cos \pi - 1}{n}\right) \frac{\sin n\pi X}{L} \exp\left(\frac{-D\pi^2 n^2 t}{L^2}\right) dX \quad \text{Eq. 6}$$

which upon integration and expansion results in

$$Q = Q_\infty - \frac{8}{\pi^2} Q_\infty \left[\sum_1^n \frac{1}{(2n-1)^2} \exp\left\{-(2n-1)^2 \frac{D\pi^2}{L^2} t\right\}\right] \quad \text{Eq. 7}$$

The diffusion coefficient is related to the temperature by the familiar Arrhenius equation

$$D = K \exp\left(\frac{-E}{RT}\right) \quad \text{Eq. 8}$$

in which R is the gas, constant, T is the Kelvin temperature and K is a constant of the system. At a fixed temperature Q_∞, D and E completely characterize the sorption process of a particular sorbent—moisture system.

Results

In developing an accelerated method one must first find a rapid way of accurately evaluating Q_∞ and D.

The following three approaches to the problem were examined:

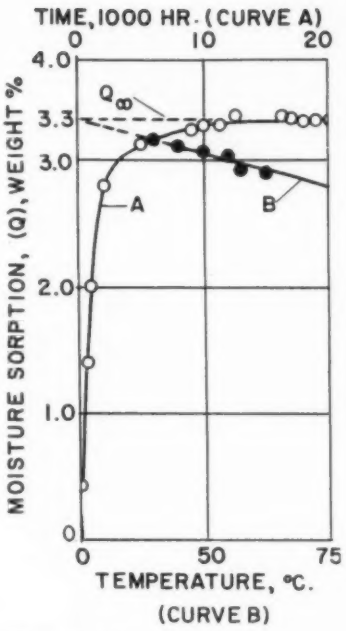

Fig. 2: Temperature and time dependence of moisture sorption in a phenolic glass laminate

a) a procedure for fitting the data, for small values of time t, in Eq. 7 employing sufficiently large values of n; b) determination of D from Eq. 7 by employing a valid, rapid, and independent estimate of Q_∞; and c) some "thermal" procedure for approaching equilibrium more rapidly.

Approaches a) and b) were not fruitful but approach c) was. Success of approach c) implies that Q_∞ and D are both single valued, continuous and extrapolative functions of temperature and also implies that there is no interference from secondary chemical or physical side reactions. The behavior of Q and Q_∞ as a function of temperature for a phenolic laminate is shown in Fig. 2, left. It can be seen that approximately two years were required for Q to attain the equilibrium value Q_∞ (3.33%) at 25° C. However, when the values of Q_∞ at elevated temperatures (lower abscissa) over the range of 45 to 70°C. were extrapolated to 25°C. the same value of Q_∞ is obtained.

The validity of this type of extrapolation suggests that with respect to temperature Q_∞ is insensitive whereas D is markedly sensitive; this behavior is again noted in Fig. 3, p. 224, in which the *time* dependence of Q at 60°C. is plotted upon the same scale as the 25°C. dependence of Q. Note that the Q_∞ value at 60°C. is 2.75 as compared with 3.33 at 25°C. The tremendous difference in diffusion rates (1300 to 3000%) is reflected in differences in the initial slopes of the two rate curves. The behavior of the phenolic laminates shown in Figs. 2 and 3 was found to be characteristic of all the laminates tested.

Accelerated method

The procedure in current use in this laboratory for the determination of Q_∞, D, and E is based on the above approach and consists of the following six steps:

1) The specimens are dried at

Table I: Fabrication parameters of the test laminates

Resin	Molding conditions			Precure		Postcure	
	Pressure	Time	Temperature	Time	Temperature	Time	Temperature
	p.s.i.	min.	°F.	hr.	°F.	hr.	°F.
CTL-91LD (phenolic)	250	15	295	17	295	10	510
Laminac 4232 (polyester)	100	30 120	200-212 250	2.5	275-400	16.5	400
APCO 1214 (polyurethane)	100	30	150	2.5	275-400	24	400
Epon 828 (epoxy) with APCO-320 hardener	100	30	320	2.5	275-400	24	400
DC 2106 (silicone)	1000	30	350	4.5	275-500	100	500

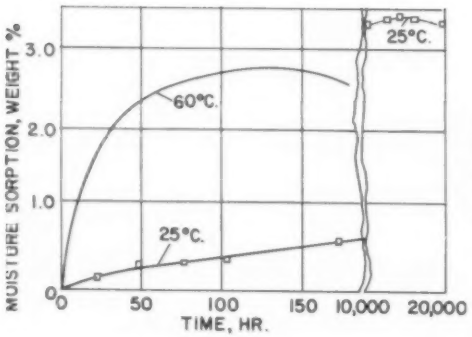

Fig. 3: Effect of temperature on rate of approach to moisture equilibrium in a phenolic glass laminate

150° C. for 17 to 48 hr., depending upon the rate of approach to an equilibrium dry state.

2) Dry specimens are immersed in distilled water at 40, 45, 50, 60, 65, and 70° C.

3) Every 24 hr. until equilibrium is reached, the specimens are blotted dry and weighed. For the three lowest temperatures, dQ/dt is plotted against Q, and the values of Q_∞ are read at dQ/dt = 0.

4) A plot of Q_∞ values versus temperature, in the range of 40 to 70° C., is then extrapolated to the value at 25° C.

5) The values of Q_∞ at each temperature, the sample thickness L, and the percentage Q of moisture absorbed at time t are substituted in the following empirical (5) relationship

$$\frac{Q^2}{t} = \left(\frac{16\ D}{\pi\ L^2}\right) Q^2_\infty \qquad \text{Eq. 9}$$

which yields D values as a function of t. The value of D at $t = 0$, which we call D_0 is obtained from a plot of D versus $1/t$.

6) The value of activation energy E is obtained by plotting the logarithm of D_0 (obtained in step 5) versus $1/T$. The slope of this line is E/R and the intercept is K where R again is the gas constant, K is a constant of the material, and the equation of the line is

$$\log D_0 = \ln K - \frac{E}{RT} \qquad \text{Eq. 10}$$

Table II: Values of Q_∞, D, and E at 25 to 80° C. for the five laminates

Resin	*Temperature* °C.	Q_∞ *g./100g. (%)*	$D \times 10^7$ *cm.²/sec.*	*E* *cal./mol. I*
CTL-91LD (phenolic)	80	—	110.4	7,300
	70	2.54	69.8	
	60	2.72	31.2	
	50	2.86	23.2	
	25	3.33	2.9	
Laminac 4232 (polyester)	80	2.77	—	7,100
	70	2.96	282.8	
	60	3.14	189.1	
	50	3.33	175.5	
	25	3.78	—	
APCO 1214 (polyurethane)	80	26.0	13.1	12,300
	70	19.9	4.0	
	60	14.1	3.3	
	50	11.6	1.5	
	25	5.0	—	
Epon 828 (epoxy)	80	3.32	49.3	16,000
	70	3.49	23.3	
	60	3.63	15.2	
	50	—	3.8	
	25	4.16	—	
DC 2106 (silicone)	80	1.11	63.9	17,200
	70	1.27	39.4	
	60	1.33	17.0	
	50	—	6.8	
	25	1.56	—	

Application of accelerated method

The method described above was applied to glass fabric laminates prepared from five different types of resins (Table I). The values of the constants over the range of 25 to 80°C. are given in Table II, below. One can observe that except for polyurethane, Q_∞ is relatively insensitive with regard to temperature. Note also the 13 to 30 fold change in D over the temperature range. Examination of the rate data of the polyurethane-glass laminate suggests that hydration is progressive and does not reach equilibrium at elevated temperatures over long (six to eight months) time intervals. The increase in activation energy appears to be dependent upon the fraction of sorbed water which was in the unbound (free) state; a theoretical treatment of this fraction is described in separate report (7).

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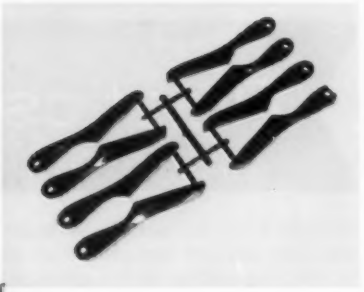

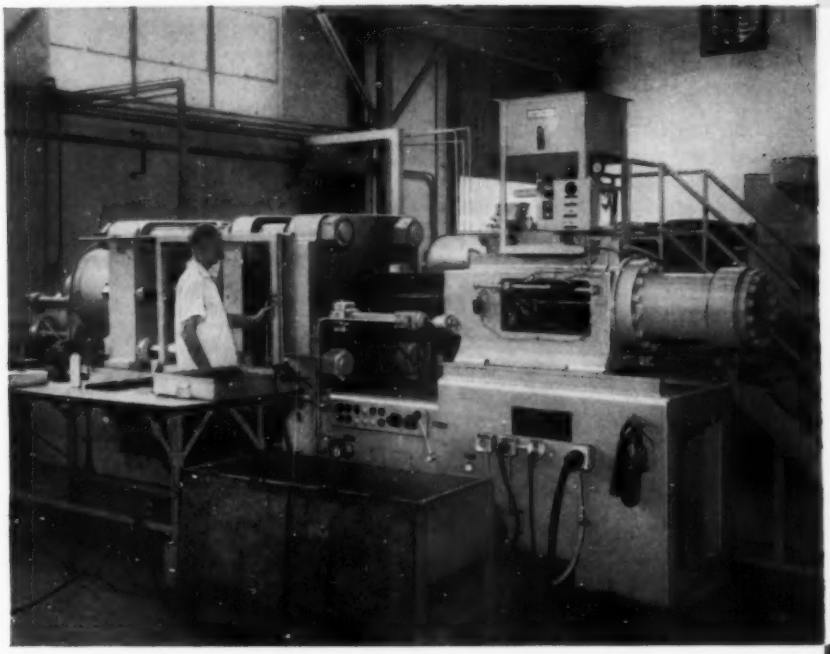

Above—Handles are molded of high-impact polystyrene. Projected area is 20½" x 8½" The weight per shot is 24½ ounces.

Left—Watson-Stillman 24-ounce injection molding machine in operation at the A. L. Hyde Company.

Below—Molded piece being removed at the completion of the cycle.

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General

Plastics: Riding high. Chem. Eng. News *36*, 73-77 (Aug. 25, 1958). Recent developments in reinforced plastics are reviewed. The sales volume has increased from about 60 million lb. in 1954 to about 165 million lb. in 1957, with a projected increase for 1958. About 92% of the resins used are polyesters. These products and 55 million lb. of fibrous glass were used in 1957. New developments include new resins, new reinforcements, and new processing. Uses are expanding.

For plastic pipe: Progress with problems. Chem. Week *83*, 77-8 (Aug. 9, 1958). The production of plastic pipe is discussed. It is estimated that the $45 million sales volume in 1957 will increase to $200 million in 1963.

Plastic gains faster in container boom. Chem. Week *83*, 100 (Aug. 9, 1958). The production of plastics containers is constantly increasing. It is estimated to be about 0.6 billion units in 1958, which is a 12,000-fold increase since 1951 when 50,000 units were used.

How can we hurdle the "materials roadblock?" I. Stambler. Aviation Age *30*, 18-19 (Aug. 1958). New and improved materials are the most pressing need in the race for air and space superiority. The properties needed for the next 10 years are prognosticated.

Good design. J. Rowan. Canadian Plastics *1958*, 34-5, 39-40 (July). The purpose and value of industrial design, how it is related to expansion in competitive markets or in the utilization of new materials, and the procedures involved are discussed. The scope of operation includes familiarity with facilities and operating personnel, sales problems, market research, production research, design, models, and controls.

Materials

Radiation-tolerant electronic materials. V. DeBiasi. Aviation Age *30*, 72-4, 76-80 (Aug. 1958). The resistance of materials of all types to high energy radiations is compared.

Properties of structural reinforced plastics. E. J. Zeilberger and J. H. Lieb. Aviation Age *30*, 90 (Aug. 1958). The properties of various types of reinforced plastics are presented in tabular form. Strengths at high temperature and erosion resistance are included among other properties.

Testing for a key role in silicone uses. Chem. Week *83*, 79-80 (Aug. 23, 1958). A new nitrile silicone elastomer resists fuels, oils, and solvents and is useful over the temperature range —100 to 500° F.

Materials progress: Non-metals. I. Stambler. Aviation Age *30*, 62-4, 66-70 (Aug. 1958). The present status of plastics, ceramics, adhesives, rubbers, hydraulic fluid, lubricants, and transparent materials research with respect to temperature resistance is reviewed. Phenolic silicone plastics will withstand 500° F. for long periods. Phenolic plastics reinforced with silica fibers will withstand 3000° F. for 10 minutes. A phenolic plastic filled with magnesium oxide has withstood 26,000° F. for short periods. The resistance of other plastics is also reported. Resinous adhesives are available that will give satisfactory performance at 800° F.

Measurement and interpretation of properties of low-density plastics. G. C. Ives. Plastics Inst. Trans. *26*, 208-24 (July 1958). The methods of evaluation, properties, and standards of cellular materials made of polyvinyl formal, cellulose, silicone rubber, polyvinyl chloride, and polyurethane are reviewed in detail. 19 references.

Molding and fabricating

Modern plastics machinery. O. F. Bartoo. Plastics Inst. Trans *26*, 251-76 (July 1958). Improvements in molding, extrusion, and forming equipment for plastics are described.

The engineering of extrusion. Brit. Plastics *31*, 270-75 (July 1958). The advantages and disadvantages of single and twin screw extrusion machines are discussed. A hypothetical case involving extrusion of tubing was selected to show variations that may occur at various phases of the extrusion operation. The effects of these variations and methods of eliminating the causes are presented. The most prominent variations occur as a result of atmospheric humidity, screw speed, temperature control, pressure, and die design.

Capacitative heating of dielectrics in h.-f. fields. Plastics (London) *23*, 250, 267 (July 1958). High-frequency electrical fields produce polarization and dipole motion in dielectrics, giving rise to frictional heat that forms the basis for high-frequency welding of plastics. Theoretical power values usually are too low to produce perfect welds in practice. This discrepancy results primarily from additional heat and power losses from the metal electrodes, and from the low-thermal conductivity of the plastics materials. Electrode design may also cause considerable variation in power losses. The use of blocks of phenolic-paper laminates between the electrodes and the material

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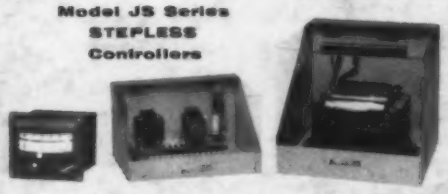

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to be welded was found to considerably reduce power losses. The laminate blocks also aid in welding very thin materials, which in theory are easy to weld, but in practice are extremely difficult to weld.

Applications

New filter plates: plastic displaces metal. C. C. Van Soye. Chem. Eng. *65*, 68, 74 (June 30, 1958). Molded reinforced polyester plastic is being used for filter plates in several commercial operations. The plates have good resistance to hot mineral acids and alkalis, hypochlorites, peroxides, chlorides, and organic solvents. Being compression molded, the surface is free of pores and pits that might trap sediment. They are also not subject to deterioration problems common to coated plates when protective coating abrades.

Plastic coatings for buried pipe. W. D. Parker. Corrosion Tech. *5*, 179–80 (June 1958). The use of PVC and polyethylene tapes for the corrosion prevention of buried pipes is discussed. Some of the protection factors which might limit the use of these materials are described, and include aging effects, attack by sulfate-reducing bacteria, and capillary leakage at lap joints. A special tape is described which overcomes some of the apparent defects of the plastic tape alone. This material incorporates a cotton or fibrous glass fabric, impregnated with a petrolatum matrix and tannins, to reduce anaerobic bacterial action, bonded to a thick PVC tape.

Resin pavement stops auto skid. Chem. Eng. News *36*, 46 (July 14, 1958). A nonskid road paving compound is based on epoxy resins.

Hydrogenated polybutadienes as bonding agents for plastics and metals. D. Wright and N. Parkman. Brit. Plastics *31*, 255 (June 1958). An experimental adhesive based on hydrogenated polybutadienes was studied. Data is presented to show attainment of marked decreases in curing temperature over that previously

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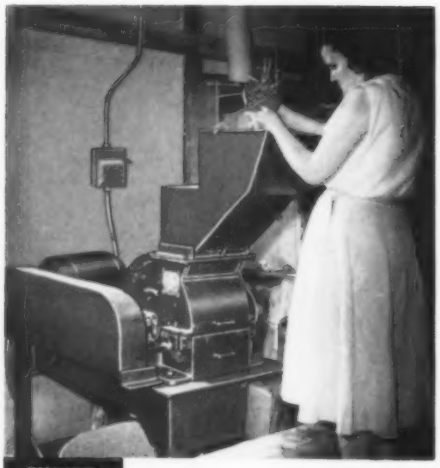

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Halofluorocarbon plastics. R. A. Smith, J. H. Kushnick, and H. S. Kaufman. Modern Packaging *31*, 131-4, 136, 177-78 (June 1958). Two grades of chlorofluorocarbon resins have been found particularly useful in the packaging of items requiring steam- or radiation-sterilization. The general properties of these materials were evaluated and compared with those of polyethylene, nylon, polyvinyl chloride, polyvinylidene chloride, cellophane, and polytetrafluoroethylene. Emphasis was given to the study of special properties such as permeability rates and heat sealability. Vacuum forming and printing techniques, and applications in the pharmaceutical fields are also described.

Plastics as solid lubricants and bearings. A. J. G. Allan. Lubrication Eng. *14*, 211-14 (1958). The use of plastics as bearings and solid lubricants is reviewed. 40 references.

'Engineered' fabrics: What they can do. L. A. Runton. Materials in Design Eng. *48*, 90-2 (July 1958). Several custom-made fabrics are described in relation to varying design criteria. Precision geared belts are made from polyvinyl chloride reinforced with cotton. The simplicity of a flat belt drive is combined with the slip-proof features of chain and gear drives. A flexible stainless steel-polytetrafluoroethylene belt has long life and can be used at temperatures up to 400° F. Phenolic resin-impregnated fabrics are being used in self-lubricating bearings.

Use of plastics in the button industry. H. F. Fields. Plastics (London) *23*, 268-9 (July 1958). A general summary of plastics materials being used in the but-

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ton industry is presented. Molding and machining properties and chemical resistance are of primary importance for materials used in this industry. Casein, the first plastic used in this application, is still in wide use, although more recently cellulose nitrate, cellulose acetate, cast phenolics, acrylics, and polyesters have been used. Injection and compression molding techniques have proved successful for most of the thermoplastics, including polystyrene and PVC, and for certain thermosetting compounds such as urea-formaldehyde. Cast acrylics and polyesters containing pearlescent materials have largely replaced natural shell in the manufacture of pearl buttons, which represents a large portion of the industry.

Properties

Flame spread properties of building finish materials. D. Gross and J. J. Loftus. ASTM Bulletin No. *230*, 56-60 (May 1958). Flame-spread data, as measured by the radiant panel method, are reported for a wide variety of materials including representative composite assemblies of interior finishes applied to common wall base materials. The base material as well as the surface finish material are important factors in the flame-spread behavior of a composite assembly. For the materials tested, the effect of the base material upon the flame-spread index of an assembly decreases as the finish material thickness increases. The standard deviation of a single observation was found to be approximately 27.8% of the mean flame-spread index for many materials but considerable variation was observed. Results of tests on many plastics materials are reported.

Creep and stress-rupture behavior of polyethylene resins. R. H. Carey. Ind. Eng. Chem. *50*, 1045-48 (July 1958). To evaluate plastics for long-time load-bearing applications, a simple creep and stress-rupture apparatus was developed. The data obtained are useful in product development of structural or semistructural application. Degree of crystallinity has a great effect on

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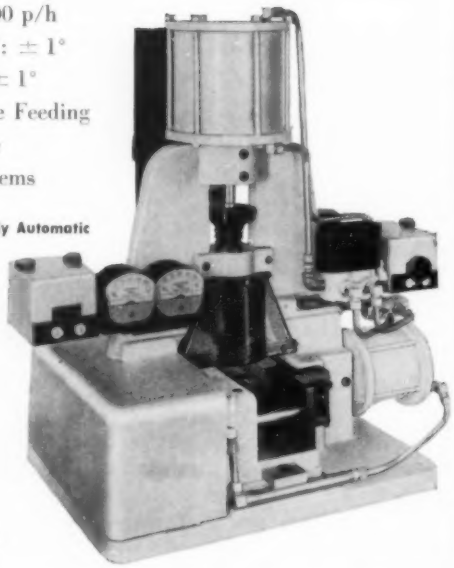

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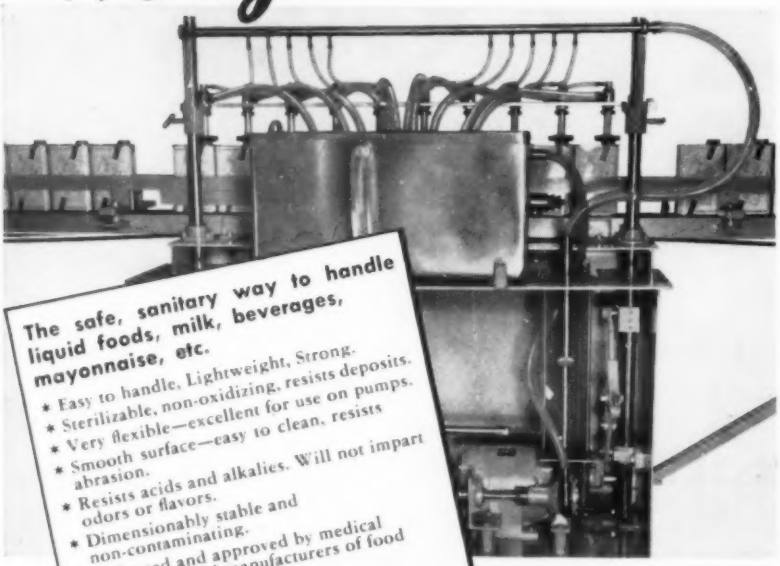

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creep behavior. For any given density (crystallinity) the probability of rupture or fracture is considerably greater for resins of high melt index (low molecular weight). Amorphous resins fail largely because of excessive creep or deformation; resins of higher crystallinity (density) fail by rupture with little elongation. The high strength with highly crystalline resins, indicated by short-time tests, has not been borne out by long-time tests. Detailed data make it possible to estimate the life expectancy and manner of failure of a spectrum of polyethylene resins.

Testing of Ziegler-polyethylene pipes. K. Richard, G. Diedrich, and E. Gaube. Rubber and Plastics Age *39*, 364-65, 367-68 (May 1958). A method for making long-time internal loading tests on plastic pipe is described. The behavior of low density and high density polyethylene materials is compared at various temperatures. A characteristic relationship observed between the creep rupture strength and time to rupture on log-log coordinates, which is very similar at different temperatures makes it possible to predict the long-time behavior of Ziegler-polyethylene pipes at room temperature on the basis of short-time tests at higher temperatures. A high-quality material tested up to 30,000 hr. at room temperature fulfills the requirements of a lifetime of more than 50 yr. at 68° F. at an allowable maximum stress of 710 p.s.i.

Reinforced plastics at 3,000° to 25,000° F. M. W. Riley. Materials in Design Eng. *47*, 100-04 (June 1958). Three characteristics that appear to be responsible for the high temperature erosion resistance of reinforced plastics are high heat capacity, low thermal conductivity, and capacity to generate surface gas on heating. The high heat capacity of hydrogen is responsible for the success of reinforcing materials of high hydrogen content such as nylon fibers. Reinforcement materials made of polyethylene may give better results. Gases generated by the material might provide a radiation barrier and should in-

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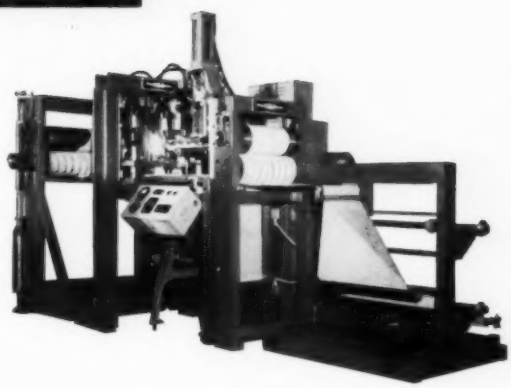

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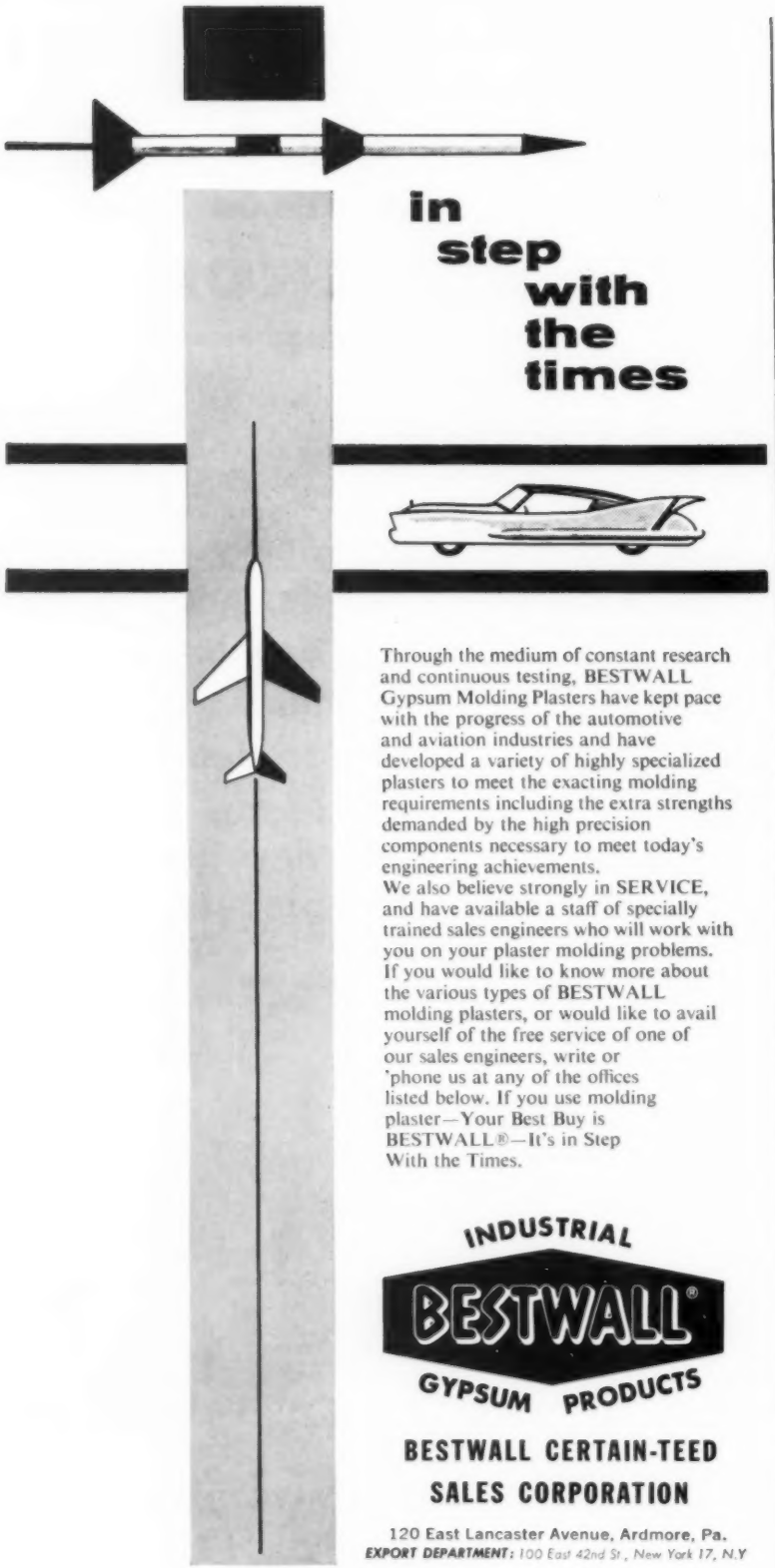

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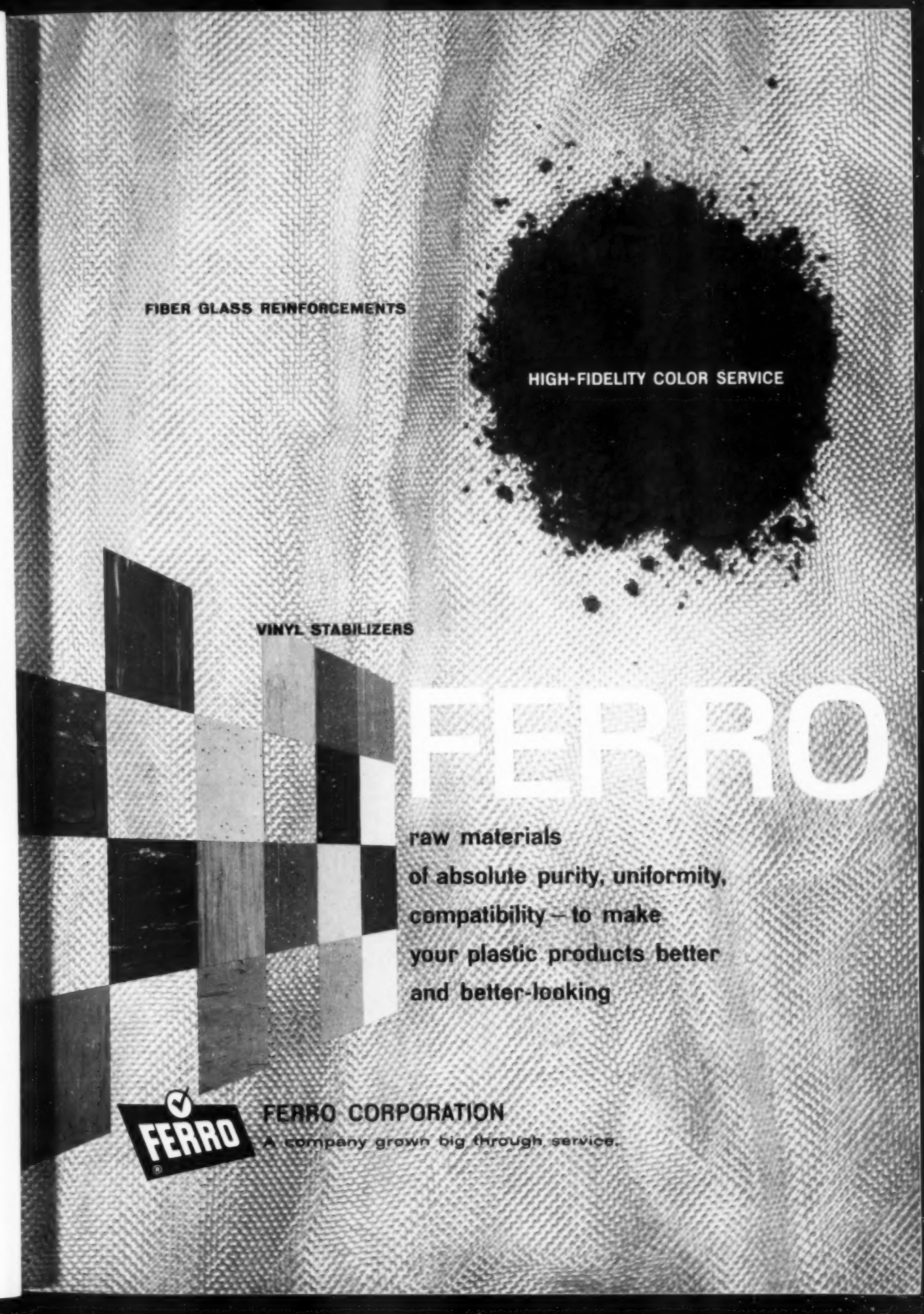
Chemical effects in the irradiation of polymers in the solid state. J. Weiss. J. Polymer Sci. *29*, 425-32 (June 1958). The action of ionizing radiations on polymers leads, in general, to degradation and in certain cases, to some further polymerization (cross-linking). It is known, on general physical grounds, that the energy of the radiation is converted into ionization and excitation of the molecules present in the system. The question arises as to how the radiation-produced primary species enter into the mechanism of the subsequent chemical processes. It is suggested that electronic processes are of considerable importance in the radiation-induced reactions of solid polymers; this is discussed with reference to various physical and chemical data on irradiated polymers (radiation-induced electrical conductivity, paramagnetic resonance, etc.) A unified picture for the mechanism of the action of ionizing radiations is proposed, based on the zone theory of solids.

Testing

A new apparatus for determining the cell structure of cellular materials. W. J. Remington and R. Pariser. Rubber World *138*, 261-64 (May 1958). Current methods of determining cell structure are based on water or solvent absorption which requires several days or weeks for each test. The apparatus described is based on a displacement of air system which requires only a few minutes per sample. A dual manometric system provides ease of measurement of air displacement. Calculations based on derived equations are rapid and simple and yield the volume percent of both open

(*To page* 241)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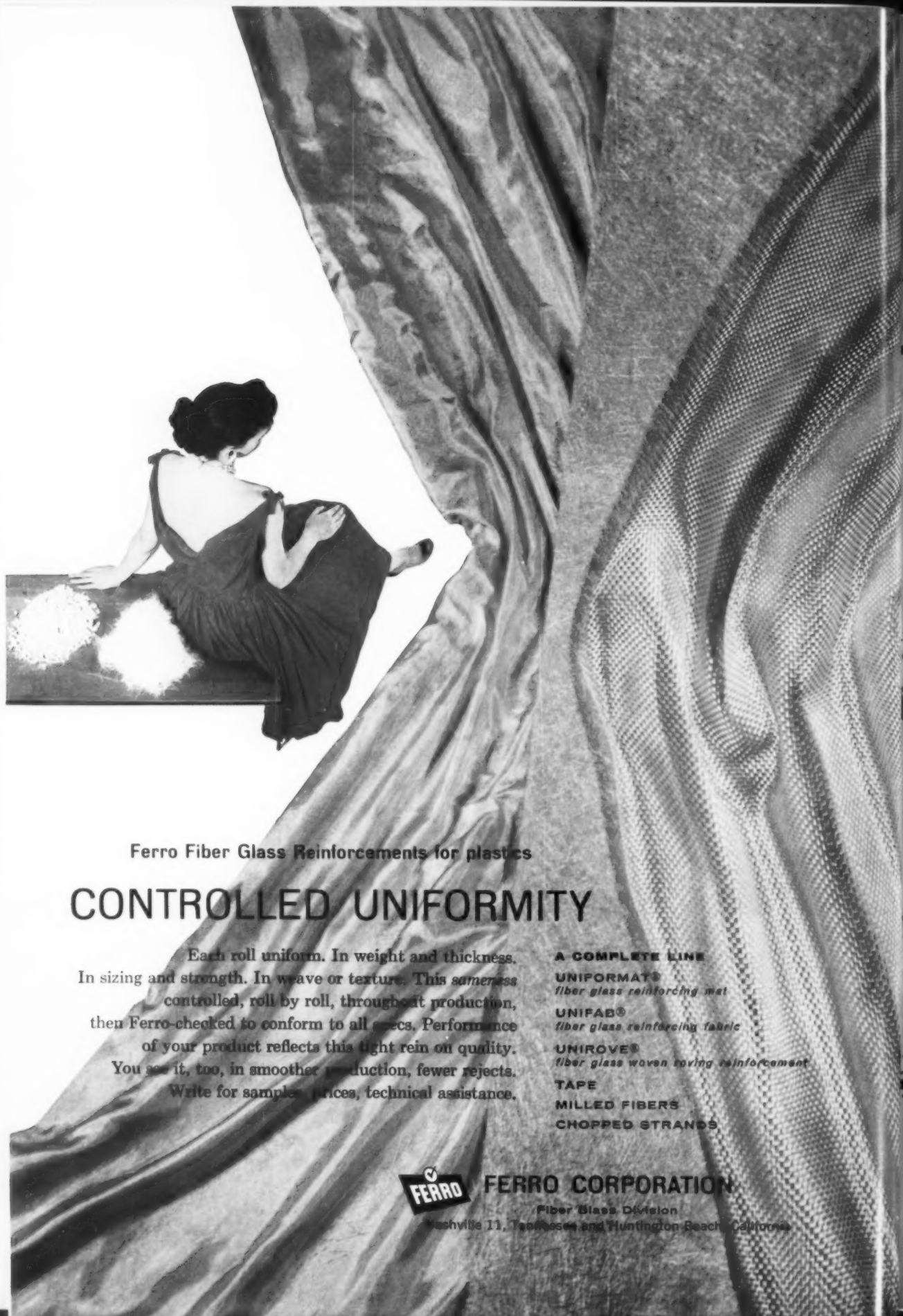

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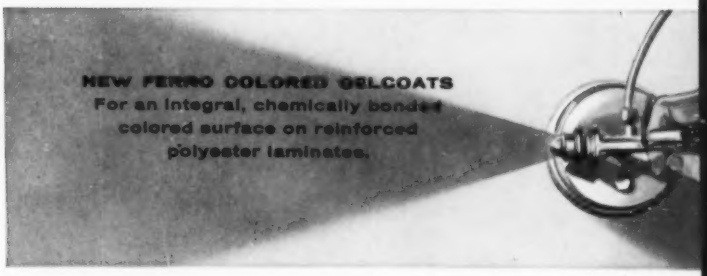

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and closed cells in the foamed material. The apparatus has been successfully used on various types of foamed plastics and rubber materials.

Analysis of amino-formaldehyde resins. J. C. Morath and J. T. Woods. Analytical Chem. *30*, 1437-40 (Aug. 1958). A summary of methods for determining the amino, formaldehyde, and/or the methanol portions of certain resins is presented. Resin components discussed are urea, thiourea, ethylene urea, melamine, free total methylol, methylenic formaldehyde, and free total methanol. The chromotropic acid method for total formaldehyde should be of particular interest because of its speed and simplicity.

Chemistry

Recent advances in polymerization techniques. H. Melville. Plastics Inst. Trans. *26*, 281-88 (July 1958). Recent developments in polymerization techniques that make it possible to synthesize more precisely macromolecules with desired properties are described briefly.

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Journal of Polymer Science: Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y.
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Plastics Institute Transactions: The Plastics Institute, 6 Mandeville Pl., London, W. 1, England.
Plastics (London): Temple Press Ltd., Bowling Greene Lane, London, E. C. 1, England.
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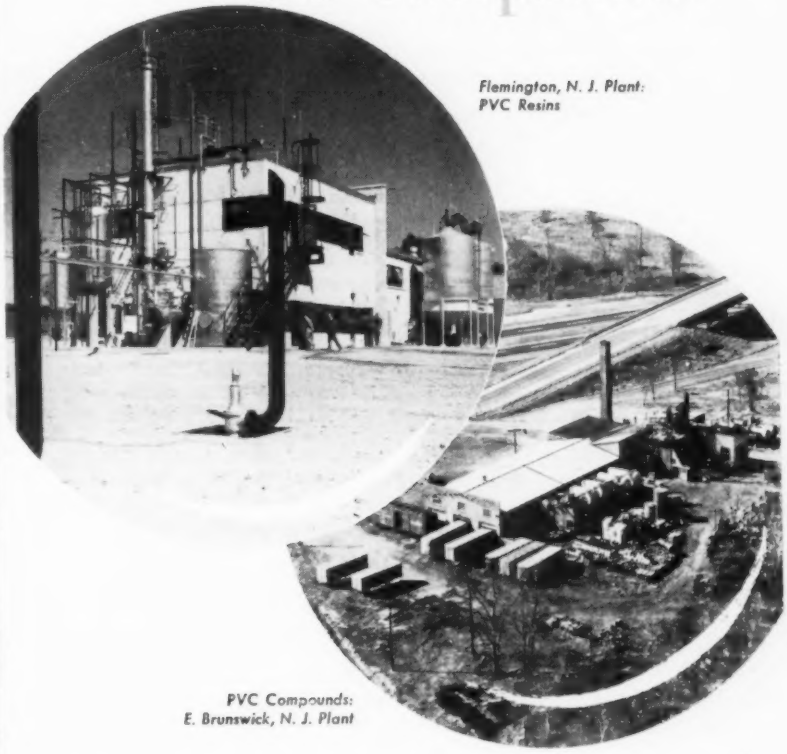

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U.S. Plastics Patents

Copies of these patents are available from the U.S. Patent Office, Washington, D.C., at 25¢ each.

Resins. J. Rosenberg and M. A. Graff (to General Electric). U. S. 2,840,540, June 24. Ethoxyline resins.

Resins. J. H. Freeman and L. E. Edelman (to Westinghouse). U. S. 2,840,542, June 24. Etherified phenolic resins.

Resins. L. H. Brown, E. A. Reineck, and P. G. Huett (to Quaker Oats). U. S. 2,840,543, June 24. Resin from furfuryl alcohol and formaldehyde.

Polymers. F. M. Precopio (to General Electric). U. S. 2,840,544, June 24. Condensation polymers of 2,6-dihydroxy-4-carboxy-pyridine.

Polymers. R. S. Yost (to Rohm & Haas). U. S. 2,840,545-6, June 24. Polymers of vinyl urea derivatives.

Resins. W. L. Stump (to Du Pont). U. S. 2,840,547, June 24. Polycarbonamides.

Polymers. B. W. Howk and J. C. Sauer (to Du Pont). U. S. 2,840,548, June 24. Polymers of unsaturated dilactones.

Polymers. D. G. McNulty and R. I. Leininger (to Diamond Alkali). U. S. 2,840,549, June 24. Polymerization of unsaturated monomers.

Polymerization. J. A. Price and W. M. Thomas (to American Cyanamid). U. S. 2,840,550, June 24. Polymerizing vinyl compounds.

Polymerization. E. Field, H. Friedlander, and O. O. Juveland (to Standard Oil). U. S. 2,840,551, June 24. Olefin polymerization.

Mold. S. K. Moxness (to Minneapolis-Honeywell). U. S. 2,840,856, July 1. Mold for plastics.

Coated fabric. W. F. Bird (to Collins & Aikman). U. S. 2,841,205, July 1. Polyurethane foam coated fabrics.

Compositions. A. B. Craig and E. L. Ringwald (to Chemstrand). U. S. 2,841,568, July 1. Compositions of polyacrylonitrile and ethylene oxalate.

Polymers. F. M. Rugg and J. E. Potts (to Carbide & Carbon). U. S. 2,841,569, July 1. Graft polymers of polyethylene and polymerizable nitriles.

Polymers. R. N. MacDonald (to Du Pont). U. S. 2,841,570, July 1. Polymers of formaldehyde.

Resins. H. P. Wohnsiedler (to American Cyanamid). U. S. 2,841,571, July 1. Melamine resins.

Polyesters. J. P. McMahon (to Wyandotte). U. S. 2,841,572, July 1. Water-soluble polyesters.

Polymers. A. H. Ahlbrecht and H. A. Brown (to Minnesota Mining). U. S. 2,841,573, July 1. Fluorocarbon vinyl ester polymers.

Polymerization. W. E. Foster (to Ethyl). U. S. 2,841,574, July 1. Anionic polymerization.

Cast forming. O. B. Billings and L. Brickman (to Johnson & Johnson). U. S. 2,842,121, July 8. Cast-forming melamine resin composition.

Copolymer. B. C. Pratt (to Du Pont). U. S. 2,842,474, July 8. Copolymers of 3-methylene-1-cyclobutene.

Polyether. E. J. Watson (to Shell). U. S. 2,842,497, July 8. Phosphorus polyethers.

Foams. P. A. Roussel (to Du Pont). U. S. 2,842,506, July 8. Polyurethane foams.

Organosiloxanes. G. L. Shannon (to Dow Corning). U. S. 2,842,509, July 8. Organosiloxane compositions.

Polymers. J. L. Jezl (to Sun Oil). U. S. 2,842,512, July 8. Polymers plasticized with tetrahydrofurfuryl naphthenate.

Resin. W. P. Fitzgerald and P. U. Smith (to Esso). U. S. 2,842,513-4, July 8. Resin containing epoxidized hydrocarbon polymers.

Elastomer. M. G. Agens (to General Electric). U. S. 2,842,515, July 8. Organopolysiloxane elastomer.

Elastomers. S. Nitzsche and M. H. Wick (to Wacker Chemie). U. S. 2,842,516, July 8. Organosilicon elastomers.

Resins. L. M. Shorr (to Dow Corning). U. S. 2,842,517, July 8. Siloxane unsaturated polyester resins.

Polymerization. H. H. Irvin (to Borg-Warner). U. S. 2,842,518, July 8. Polymerization of vinylidene chloride-acrylonitrile.

Copolymers. B. A. Ripley-Duggan (to Distillers). U. S. 2,842,519, July 8. Graft copolymers.

Elastomers. K. E. Polmanteer and R. J. Koch (to Dow Corning). U. S. 2,842,520, July 8. Vinyl silicone elastomers.

Siloxanes. S. Nitzsche and M. H. Wick (to Wacker-Chemie). U. S. 2,842,521, July 8. Alkoxy alkyl siloxanes.

Siloxanes. C. L. Frye (to Dow Corning). U. S. 2,842,522, July 8. Hydroxy-alkoxylated organosilicon compounds.

Resins. W. F. Tousignant and T. Houtman, Jr. (to Dow). U. S. 2,842,-523, July 8. Carbonate resins.

Interpolymers. G. Gateff and J. A. Klupar (to Goodrich). U. S. 2,842,525, July 8. Vinylidene cyanide interpolymers.

Polymers. F. M. Smith and J. E. Pritchard (to Phillips). U. S. 2,842,-526, July 8. Polymers of vinylcyclohexanethiols.

Polymers. R. L. Herbst, Jr. and B. F. Landrum (to Minnesota Mining). U. S. 2,842,528-9, July 8. Fluorine-containing polymers.

Polymers. W. N. Baxter (to Du Pont). U. S. 2,842,531, July 8. Phenylalkene hydrocarbon polymers.

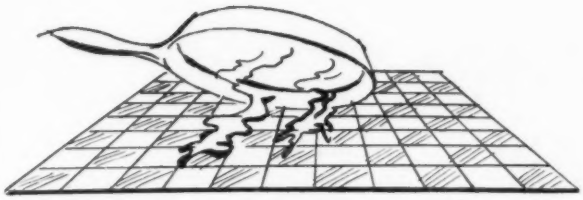
Polyesters. E. P. Wenzelberger (to Commonwealth Engineering). U. S. 2,843,553, July 15. Dextran-modified polyester resins.

Polysiloxane. C. A. Berridge (to General Electric). U. S. 2,843,555, July 15. Room-temperature-curing polysiloxane.

Resin composition. M. M. Safford (to General Electric). U. S. 2,843,-557, July 15. Epoxy resin composition.

Resin composition. Y. Fujisaki and H. Kobayashi (to Asahi Kasei Kogyo Kabushiki Kaisha). U. S. 2,843,558, July 15. Compositions of polyacrylonitrile.

Resin. F. L. Ingley and D. Moldovan (to Dow). U. S. 2,843,561, July 15;



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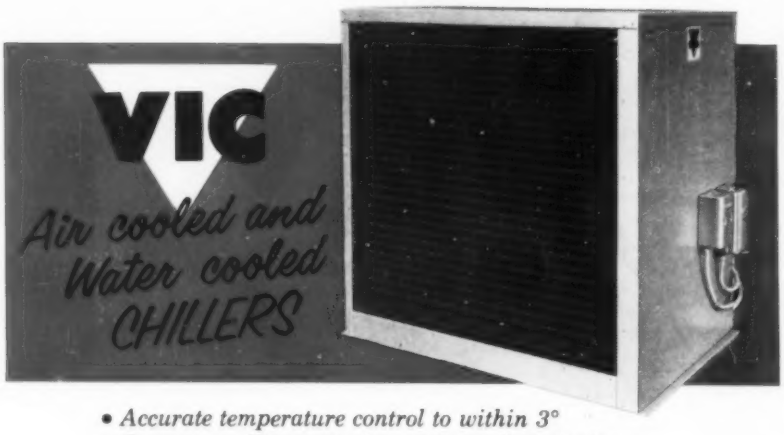

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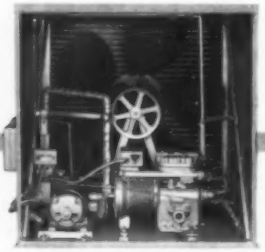

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interpolymerized compositions of vinyl aromatics, acrylic esters, and butadiene-styrene copolymers.

Copolymers. J. R. Caldwell (to Eastman Kodak). U. S. 2,843,562, July 15. Graft copolymers of vinyl chloride and polyvinyl alcohol.

Polyethylene. A. Bell and C. E. Tholstrup (to Eastman Kodak). U. S. 2,843,563, July 15. Stabilized polyethylene.

Condensates. H. Schultheis and D. Delfs (to Bayer). U. S. 2,843,564, July 15. Resin condensates.

Resins. R. M. Christenson, L. O. Cummings, and A. R. Bader (to Pittsburgh Plate). U. S. 2,843,565-6, July 15. Butylphenol-aldehyde resins.

Catalysts. J. L. R. Williams and K. R. Dunham (to Eastman Kodak). U. S. 2,843,567, July 15. Titanium alkoxide catalysts for aromatic polycarbonates.

Polyurethanes. A. F. Benning, J. G. Burt and E. K. Gladding (to Du Pont). U. S. 2,843,568-9, July 15. Polymeric polyether-polyurethanes.

Polymers. H. W. Coover, Jr. (to Eastman Kodak). U. S. 2,843,570, July 15. Alkyl and aryl isopropenyl sulfone polymers.

Interpolymers. W. C. Wooten, Jr. and D. J. Shields (to Eastman Kodak). U. S. 2,843,572, July 15. Vinylidene chloride interpolymers.

Polymers. S. Melamed (to Rohm & Haas). U. S. 2,843,573, July 15. Quaternary ammonium polymers.

Copolymers. E. F. Jordan and W. S. Port (to U. S.). U. S. 2,843,574, July 15. Copolymers of vinylidene chloride and long chain acrylates.

Copolymers. J. M. Hoyt (to Minnesota Mining). U. S. 2,843,575, July 15. Fluoroprene copolymers.

Polymers. J. H. Dunn and P. W. Trotter (to Ethyl). U. S. 2,843,576, July 15. Vinyl polymers.

Polymers. G. E. Langlois and P. E. Fischer to (California Research). U. S. 2,843,641, July 15. Propylene polymers.

Molding. R. M. Bateman and N. E. Hollis (to Richardson). U. S. 2,844,327, July 22. Preparing a moldable resin composition.

Polysiloxanes. G. H. Wagner and C. E. Erickson (to Carbide & Carbon). U. S. 2,844,435, July 22. Process for preparing polysiloxanes.

Polymerization. A. B. Borkovec

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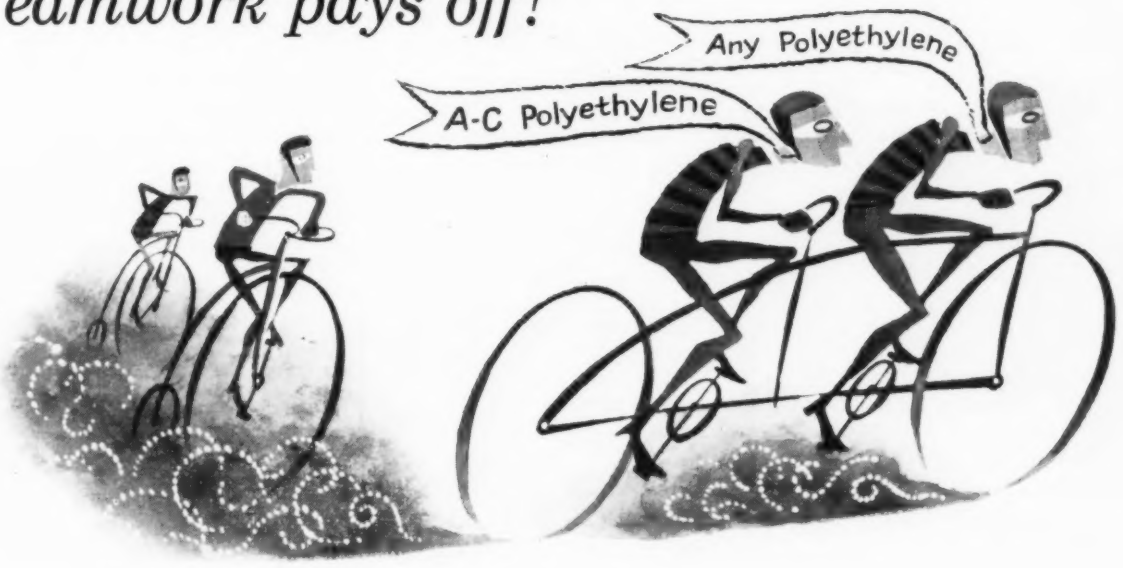

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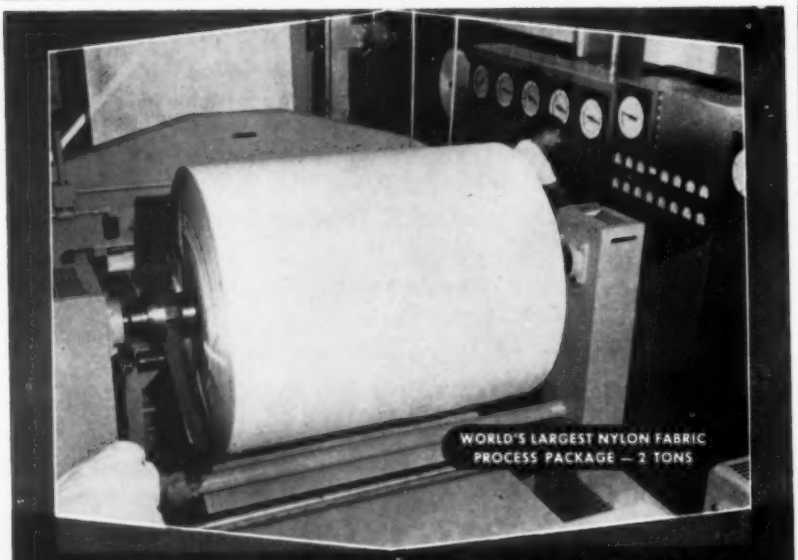

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(to Dow). U. S. 2,844,545, July 22. Polymerization of olefins.

Ion exchange. I. M. Abrams (to Chemical Process). U. S. 2,844,546, July 22. Cation-exchange resins.

Resin. D. Glaser (to General Mills). U. S. 2,844,552, July 22. Stabilizing mixtures of polyamide epoxy resin solutions with formic acid.

Resins. R. S. Taylor and L. N. Whitehill (to Sherwin-Williams). U. S. 2,844,553, July 22. Polyhydric phenol-aldehyde-epihalohydrin resins.

Resins. R. F. Nichols and L. C. Kreider (to B. F. Goodrich). U. S. 2,844,554, July 22. Diisocyanate-linked polyurethane elastomer and beeswax.

Polymers. A. D. F. Toy and R. S. Cooper (to Victor Chemical). U. S. 2,844,558, July 22. Dialkenyl beta-cyanoethanephosphonate polymers.

Polymers. E. E. Parker (to Pittsburgh Plate). U. S. 2,844,559, July 22. Polyesters of alpha-ethylenic dicarboxylic acids.

Polyesters. H. Greenberg and R. W. Horst (to National Distillers). U. S. 2,844,560, July 22. Polyesters of dicyclohexyladipic acid.

Polymerization. M. F. Bechtold and R. N. MacDonald (to Du Pont). U. S. 2,844,561, July 22. Dispersion polymerization of formaldehyde.

Resins. H. Schwarz, W. Kallert, C. Muhlhausen and H. Holtschmidt (to Bayer). U. S. 2,844,566, July 22. Polythioethers.

Polyvinyl alcohols. A. E. Broderick (to Carbide & Carbon). U. S. 2,844,570-1, July 22. Hydroxyalkylated polyvinyl alcohols.

Resins. F. R. Hansen and S. B. Elliott (to Ferro). U. S. 2,844,572, July 22. Stabilization of halogenated hydrocarbon resins.

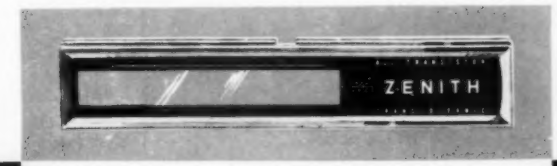
Resins. J. L. Rendall and D. R. Husted (to Minnesota Mining). U. S. 2,844,599, July 22. Polyalkylene-polyamines.

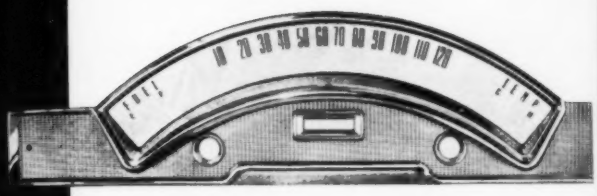
Polymers. R. G. Bistline, Jr., W. S. Port, A. J. Stirton, and J. K. Weil (to U. S.). U. S. 2,844,606, July 22. Polymerizable esters of sulfonated fatty acids.

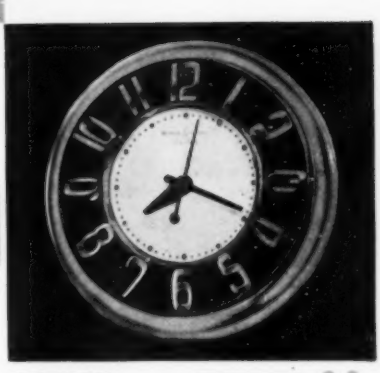
Extrusion. C. A. Kronholm (to Chester Packaging). U. S. 2,844,846, July 29. Plastic film extruder.

Cellular resins. K. F. Krebs and P. F. Urich (to Carbide and Carbon). U. S. 2,845,396, July 29. Cellular phenolic resins.

Composition. R. G. Newberg and







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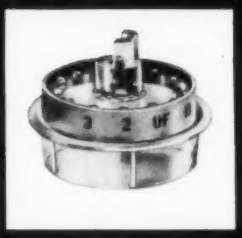

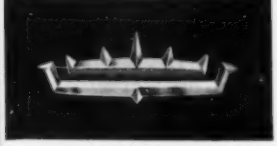

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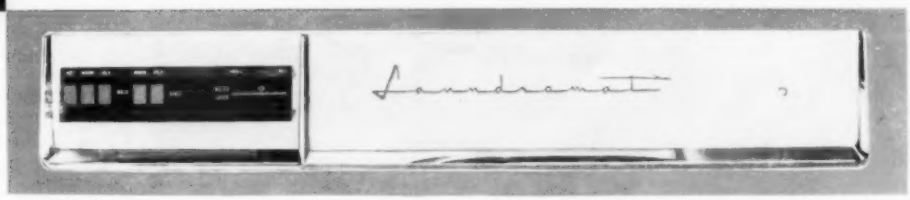

R. E. Clayton (to Esso). U. S. 2,845,-399, July 29. Isoolefin-vinyl aromatic copolymers.

Resins. B. Rudner (to W. R. Grace). U. S. 2,845,400, July 29. Hydrazine resins.

Polymers. H. C. Woodruft (to General Electric). U. S. 2,845,402, July 29. Water-insoluble polyesters.

Polymers. H. K. Garner, H. F. Jordan and W. V. Smith (to U. S. Rubber). U. S. 2,845,404, July 29. Internally plasticized polyvinyl chloride.

Resins. W. H. Watanabe and S. Melamed (to Rohm & Haas). U. S. 2,845,407, July 29. Polymers of amino-alkyl vinyl ethers.

Resins. S. Melamed (to Rohm & Haas). U. S. 2,845,408, July 29. Polyamides.

Polyethylene. A. C. Goodrich and T. R. Liston (to Allied Chemical). U. S. 2,845,413, July 29. Modified polyethylene.

Molding. C. H. Beare (to General Motors). U. S. 2,845,657, Aug. 5. Plastic molding apparatus.

Polymers. H. Kleiner, O. Bayer and H. Wilms (to Bayer). U. S. 2,846,406, Aug. 5. Polymeric amines.

Cellular plastic. F. Brochhagen, B. Koln, F. Schmidt, and P. Hoppe (to Bayer). U. S. 2,846,408, Aug. 5. Cellular polyurethane plastics.

Polymers. R. J. Herschler, R. G. Jaffe and F. O. Whipple (to Crown Zellerbach) U. S. 2,846,409, Aug. 5. Furfuryl alcohol polymer.

Resin. F. Armitage and L. G. Trace (to Sherwin-Williams). U. S. 2,846,-410, Aug. 5. Thermosetting compositions of styrene and cinnamic acid ester of epoxide resin.

Polymer. E. W. Meyer and J. G. Klein (to Glidden). U. S. 2,846,411, Aug. 5. Unsaturated polyester.

Polymer. C. B. Havens (to Dow). U. S. 2,846,412, Aug. 5. Chloroethylene polymer.

Polymers. W. A. Reeves and J. D. Guthrie (to U. S.). U. S. 2,846,413, Aug. 5. Phenolic methylol-phosphorus polymers.

Resin. A. F. Schmutzler (to American Cyanamid). U. S. 2,846,414, Aug. 5. Dicyandiamide resin.

Copolymers. M. W. Duke (to Dow). U. S. 2,846,415, Aug. 5. Acetone-soluble copolymers of vinyl chloride.

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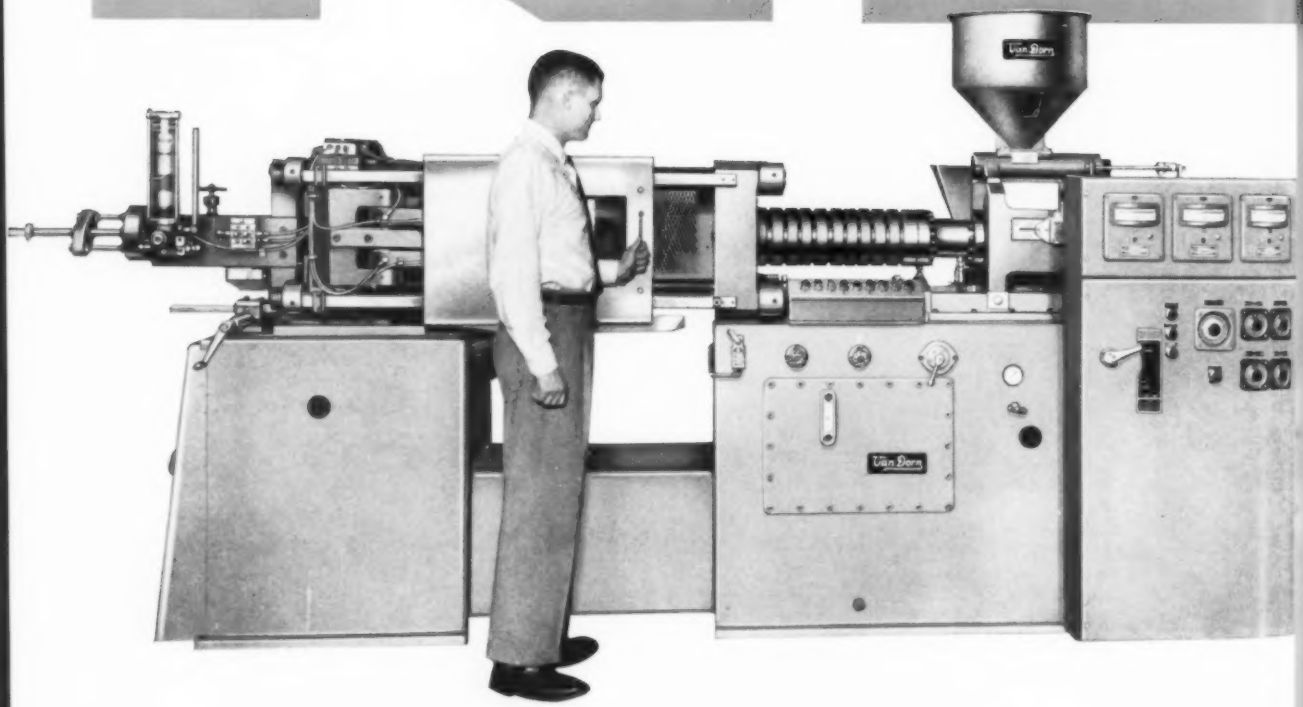

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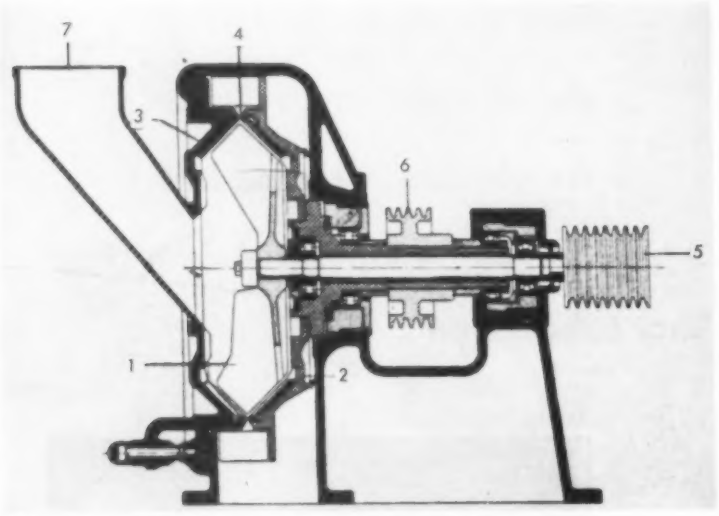
The C-64 is a high-frequency sealer having a platen area of 15 by 24 in. and a sealing capacity of up to 70 lineal inches. Top sealing load is 1500 lb., requiring an air supply of 80 to 120 p.s.i. The machine is constructed so that it may be used with equal convenience for processing either precut materials or roll-fed stocks. Optional accessories include: arc suppressors, preheated platens, factory-designed and -built dies and nest plates, automatic feed and control systems. Price: $2000. *Reeve Electronics, Inc., 609 W. Lake St., Chicago 6, Ill.*



Pallmann mill can reduce plastics to fine powder without the aid of liquid nitrogen or other costly coolants. 1) rotor; 2) circulating baffle plate; 3) fixed baffle plate; 4) discharge slot; 5) rotor drive; 6) baffle plate drive; 7) feed

Extrusion thickness monitor

An instrument that continuously measures the wall thickness and concentricity of extruded pipe and tubing keeps quiet when all is well but sounds an alarm when preset limits are exceeded. No access to inside of tube is needed, and measuring head can be attached (usually between cooling bath and take-off) after extrusion has started. Instrument can be hooked up to a recorder, or to controller of take-off speed. Interchangeable heads are available for all standard sizes of tubing. Tests in production, according to the manufacturer, have shown that this instrument can reduce set-up time, lets operator work reliably to closer limits, reduces scrap percentage, and immediately reveals defects inside tube. *Haynes & Haynes, Ltd., 32 Old Church St., London S.W. 3, England.*

Foam splitter

A low-cost manually controlled foam splitter designed for use where automation features are not needed, will handle blocks of synthetic foam up to 30 in. thick by 72 in. wide by 96 in. long. It is capable of slitting such blocks into any thickness from $\frac{1}{16}$-in. sheets to 6-in.-thick pads. Features include: vertical power-driven head, interchangeable guide bars, adjustable automatic hold-down compressor roll. Can be installed in four hours. *The Falls Engineering & Machine Co., 1734 Front St., Cuyahoga Falls, Ohio.*

Resin mixing, metering

NoVo mixing and metering systems, formerly supplied by Applied Engineering Associates (see this dept., Nov. 1956, p. 198) are now being marketed by Mitchell

*Specifications, claims made, and prices appearing in these pages are those of the manufacturers or sellers of the machinery and equipment described, or their agents. Prices are deemed to be F.O.B. sellers' plants (unless otherwise stated), are for "standard" models and are subject to change without notice. The publishers and editors of MODERN PLASTICS do not warrant and do not assume any responsibility whatsoever for the correctness of the same, or otherwise.

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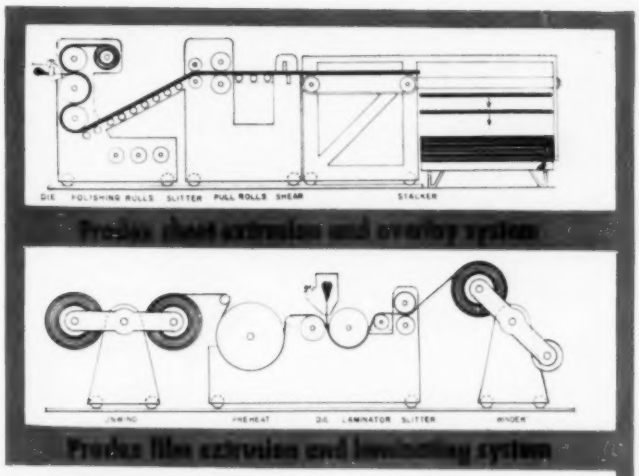

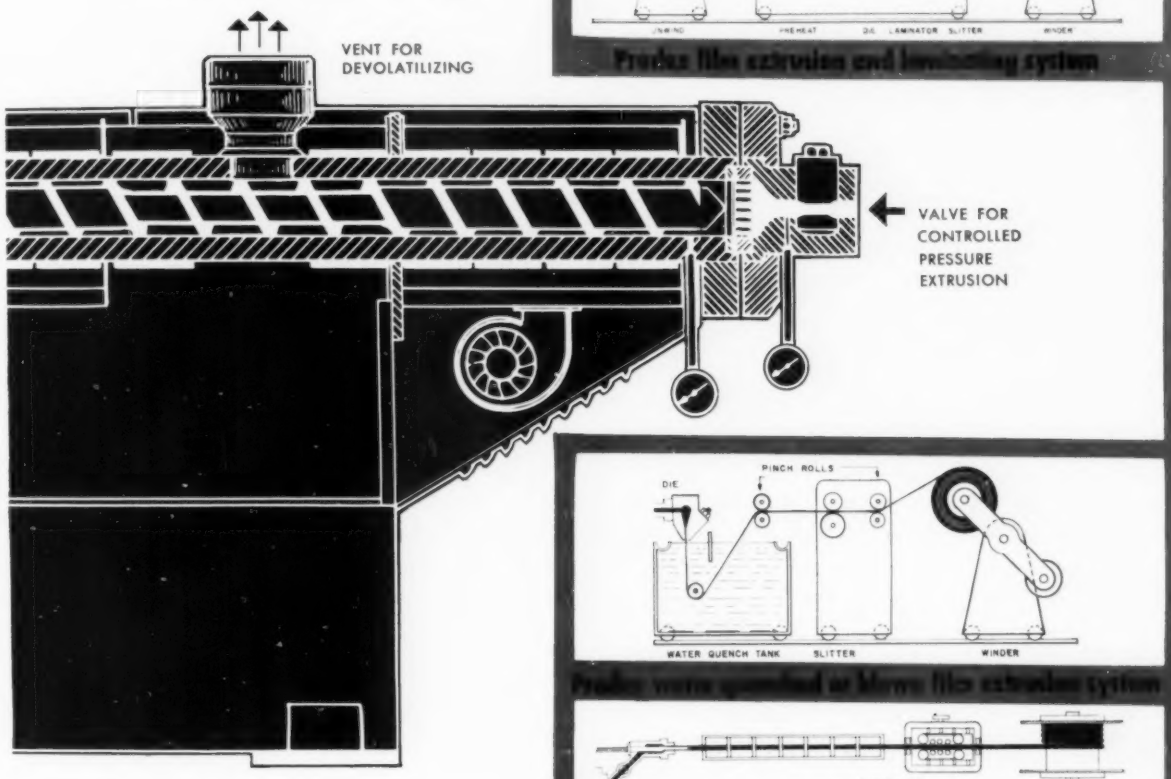

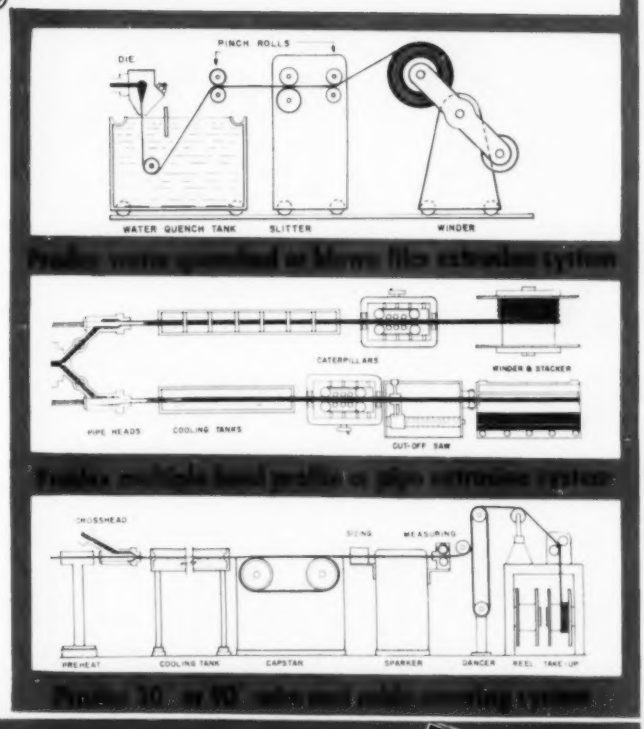

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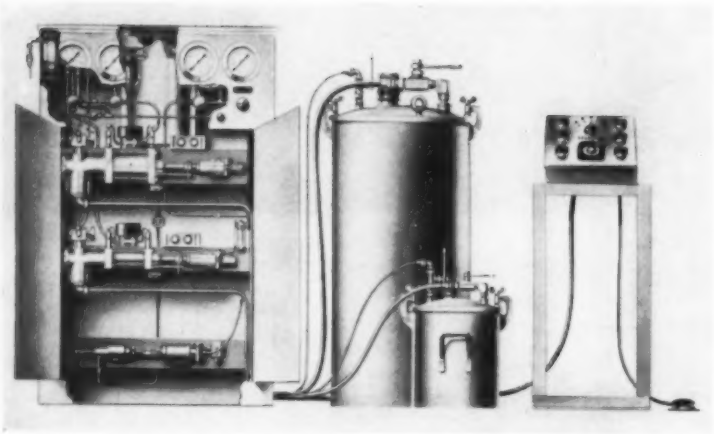

NoVo system for automatic metering, mixing, and dispensing of multi-component reactive liquid mixes

Specialty Div. of Industrial Enterprises, Inc. Marvin Schneider, formerly of AEA and the designer and inventor of these systems, has joined Mitchell. The equipment is useful in handling multi-component reactive resins such as epoxies, polyurethanes, etc., with pot lives as short as 8 to 10 seconds. Solvent-purge equipment is built in. Output can be continuous or intermittent with up to 120 shots per minute. Modifications to meet special problems (e.g., degassing of resin) are possible, and, in general, the equipment can be tailored to do the desired job without frills. *Industrial Enterprises, Inc., Edmund and Shelmire Sts., Philadelphia 36, Pa.*

Epoxy spraygun

An important requisite in working with epoxy resins is that the resin and hardener must be thoroughly mixed. It is desirable also to get a fast cure at room temperature, yet have a useful pot life. The Gusco spraygun, whose development has been assisted by Bakelite Co., combines all these features for the first time, it is claimed. Intimate mixing is achieved in the nose chamber of the gun and as the resin mix flows through the tiny spray orifice. The chamber volume is very small, and trouble-free operation has been enjoyed with resins that harden within 8 min. after being sprayed in 10-mil-thick films. In combination with a Brenner glass chopper, the spraygun can be used for reinforced epoxy molding by sprayup, with substantial production economies. The gun is so designed that the mixing chamber is emptied when the trigger is released, and can be left overnight without even resin purging. It is reported that even short squirts of resin are properly proportioned and mixed. Up to 20% of certain fillers can be incorporated in the resin. Nonskid surfaces can be made by spraying together mixed epoxy resin and sand. The gun, light and compact, is available in two sizes that presently deliver about 6 gal./hr. and 10 to 12 gal./hr., and are expected to deliver even more with a higher-pressure pumping system now nearing readiness. For best properties in the finished resin, accurate metering equipment must be used. Entire set-up costs about $3500. *A. Gusmer, Inc., Prospect and Barron Aves., Woodbridge, N. J.*

Barrel-finishing machines

Tumbling machines in the Model 30 series have glass-reinforced plastic safety gates, full-opening doors that are positively sealed by cam locks that seat the doors on Neoprene gaskets. V-belt drive is quiet, long wearing. Safety controls prevent machine from operating with gate open except for jogging. Twenty models ranging from 5 to 30 cu. ft. in capacity and having one to six compartments are offered, designed for both wet and dry processes. Standard cylinders are lined with ¼-in.-thick Neoprene, but other lining materials are available. *Techline Div., Wheelabrator Corp., 1254 Ave. V, Vicksburg, Mich.*

Presses for flat work

Designed for laminating, bonding, and embossing sheet materials, the Acraplate line of hydraulic presses is offered in seven tonnages from 180 to 400, with platens from 24 by 20 in. to 36 by 28 inches. Heavy side-plate construction and large rams insure parallelism of the platens within 3 mils over the full area. All models are provided with calibrated pressure controls, can be equipped for either hand-lever or push-button operation. Time cycle controller and speed controller are optional extras. Standard daylight is 7 in., but others may be had. Platens may be either electrically or steam heated, or unheated. *Lake Erie Machinery Corp., P. O. Box 68, Buffalo 17, N. Y.*

Destaticizer for stacked sheets

Ionizing air nozzles having static electricity eliminators built into the tip of each nozzle will positively prevent feeding of more than one sheet at a time in printing presses, etc. Air pressure used is 15 to 50 p.s.i., regulated as steady flow by stopcock, or used intermittently under control of optional solenoid valve. Ionized air from the nozzles flutters the top few sheets and neutralizes static charges generated as the sheets separate. Nozzles are available in different sizes and shapes, adapted to specific jobs. Nozzles are also useful in cleaning dust and lint off sheets, and off continuous webs on roll-fed machines. *The Simco Co., 920 Walnut St., Lansdale, Pa.*

Accessories for Lab-Vac former

The Lab-Vac sheet thermoforming machine has been brought up to date with several new accessories. Intended for forming prototypes, testing designs, etc., and for short production runs, the accessories permit plug-assist and air-cushion forming of deep-drawn parts. Also auxiliary clamping frames are now available to handle pieces smaller than

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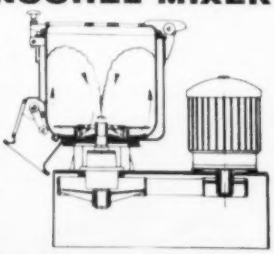
A cage-like ring of pins rotates concentrically around a stationary ring of pins. The rotating member also carries specially shaped blades and impellers which aerate and propel the powders to be mixed. The action is similar to that of a high-speed stirrer. The aerated powders or granules flow downward through the center of the rotating ring and pass through the zone of shearing between the rotating and stationary pins. The blend then moves upward along the wall of the mixing chamber. The entire batch rotates slowly around the axis of the mixing chamber. The rotating member of the mixing mechanism is usually operated at peripheral speeds of 100 to 200 ft/sec. The spacing between the rotating and stationary pins determines the shearing action. The shearing action controls mixing and dispersion as well as mechanical heat-up.



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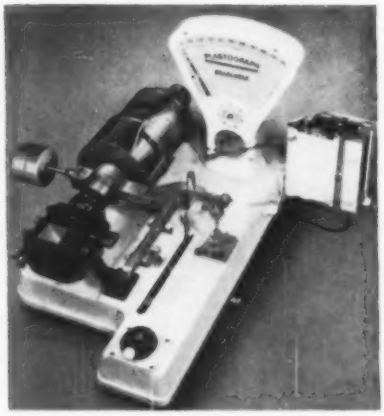

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the maximum 18 by 18 in.; they are easily mounted within the standard frames. A roll-feed attachment offers savings in sheet costs. An angle-iron table is now available to hold this bench-model machine. Several new instruments improve control. *Auto-Vac Co., 1984 State St. Ext., Bridgeport, Conn.*

Solids mixer

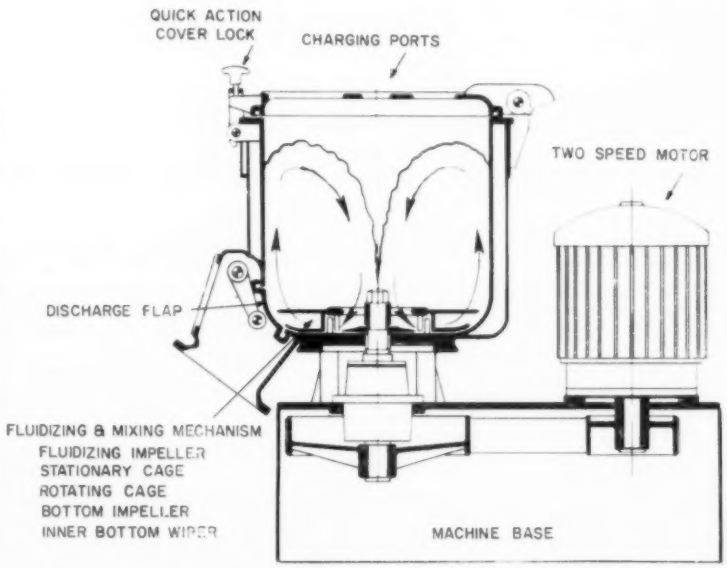
The Henschel fluidizing mixer has a 4-bladed, horizontal impeller in the bottom of the mixing chamber (see accompanying drawing) that flings solid particles upwards at the outside while whirling them. The double vortex thus produced results in very rapid batch mixing of solid particles, as in color blending of molding powders. The mixer can also be used to work liquids into powders, e.g., plasticizers into vinyl resins, providing the mixture does not become pasty. Mixing times are said to be much shorter than in other types of blenders, and excellent color dispersions are obtained. Two sizes are available: the FM 150C has a working volume of about 7.5 cu. ft. and is powered by a 25-hp. motor; working volume of the FM 500A is about 25 cu. ft., drive power is about 75 hp. The larger model is jacketed.

Around a ring in the underside of the rotor are embedded pins that pass close to a ring of similar pins projecting from the bottom of the mixing chamber (see drawing). Since the clearance between the pins is small and the velocity on the order of 100 ft./sec., shear rates are very high in the clearances.

Since all the power input eventually appears as heat, the mixer can also be used to preheat powders faster and more evenly than by simple heat transfer methods. Developed in Germany, this mixer is made and sold in the U. S. by *Prodex Corp., King George Post Rd., Fords, N. J.*

Injection molder

The Model 703 is an injection machine with a nominal shot capacity of 6-oz. that offers all the automation features of the Model 701 2-ouncer by the same maker. The vertical design, with vertical clamping, uses horizontal combing to separate parts from runners, facilitates handling of inserts. The nozzle is equipped for positive shut-off which eases nylon molding, permits precompression of melt before injection, with attendant advantages (see p. 187). Mechanical features include: positive leveling, automatic greasing of important moving parts, mold protection during



Henschel fluidizing mixer has four-bladed horizontal impeller in the bottom of the mixing chamber. Mixer is available in two sizes: 7.5 and 25 cu. feet

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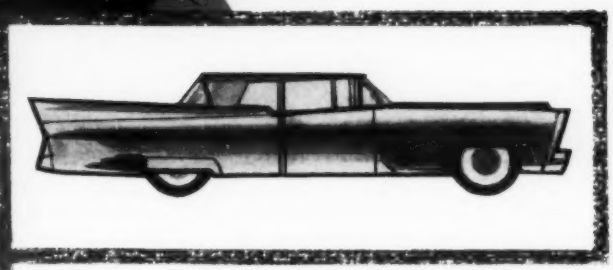

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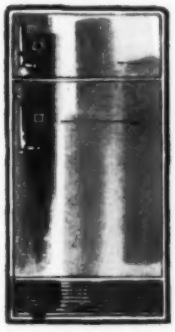

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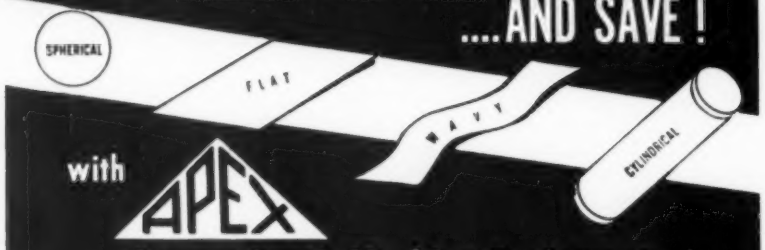

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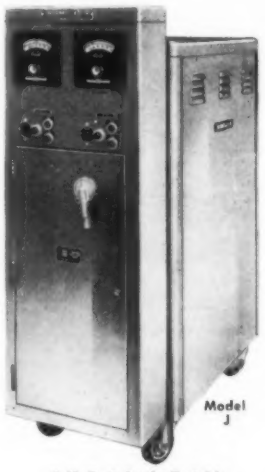

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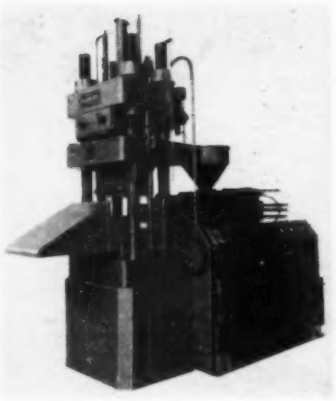

Stokes Model 703 injection molding machine has 6-oz. shot capacity

closing. Plasticating capacity is 80 lb./hr., clamping capacity is 250 tons, top injection pressure is 19,600 p.s.i. Maximum mold dimensions are 23.5 in. L to R, 14.8 in. F to B. Daylight is adjustable between 26 and 34 inches. Clamp stroke is 12 in., injection stroke is 9 in., top injection-ram displacement rate is 465 cu. in./minute. Dry cycle time is 8 sec. with positive ejection, minimum molding cycle is 15 seconds. *F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa.*

Fast injection machine

The Model M-1 $^{12}/_{16}$-oz. molder dry cycles in 5 sec. and features an enlarged mold plate capacity: it will take molds measuring up to 30 in. wide by 20 in. tall, or 16 in. wide by 32 in. tall. Minimum mold thickness is 8 in., daylight is 32 in., clamping stroke is 24 in., injection stroke is up to 11.5 inches. Clamping force is 400 tons, top injection pressure on ram is 22,500 p.s.i. at 1000 p.s.i. in the hydraulic system. Pump has a capacity of 73.3 g.p.m., is driven by a 30-hp. motor. Plasticating capacity (polystyrene) is 150 lb./hr.; heating cylinder power is 20.5 kw., maximum. Weigh feeder is optional extra. *De Mattia Machine & Tool Co., Clifton, N. J.*

Press pads

Pads of Duroid 5610—a sheet material made of TFE resin reinforced with ceramic fibers—have been found useful in some kinds of compression molding for distributing the platen pressure

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when platens are not parallel or when non-uniform molding materials are involved. These pads are much more resistant to permanent deformation than pure TFE resin, and have been used successfully at pressures up to 2000 p.s.i. and temperatures as high as 550° F. One pad was still serviceable after 2400 3-min. cycles at 350° F. and 1500 p.s.i. *Rogers Corp., Rogers, Conn.*

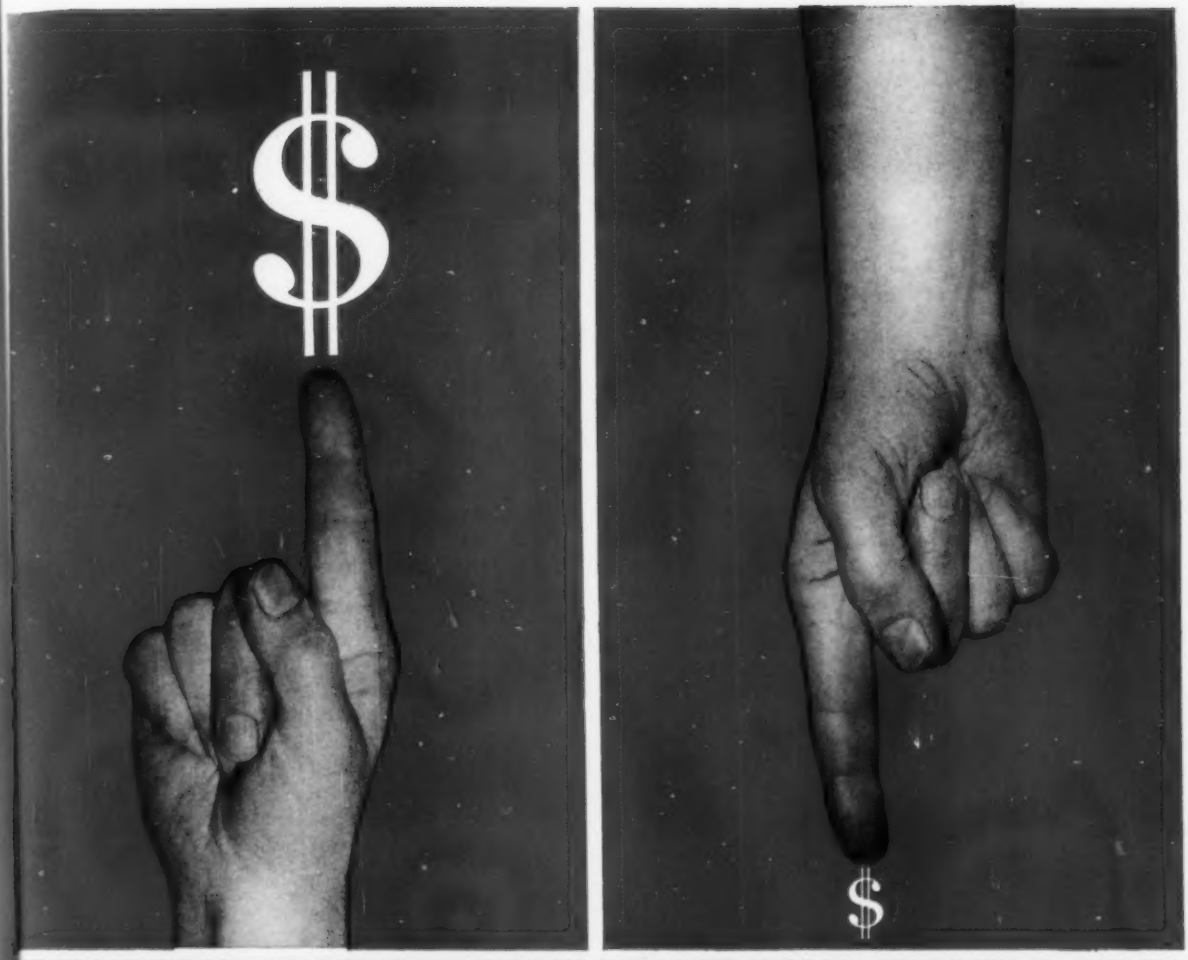
Diamond saws

Electro-Bond saws are circular saws with diamond-coated rims instead of the conventional teeth. They are particularly recommended for sawing reinforced plastics laminates, offering speed of operation and long life in this service. They are available in diameters up to 24 inches. The maker also offers shaped diamond-coated tools. *W. F. Meyers Co., Bedford, Ind.*

Spray gun for foam

A compact spray gun makes it possible to spray rigid urethane foam on vertical or overhead surfaces without sagging. Thicknesses from 3/16 to 2 in. can be built up in continuous operation. The two components of the resin system are sprayed out of concentric openings in the mouth of the gun. The atomized liquids are mixed in mid-air by additional air jets, to complete the foaming reaction in 5 seconds. The foam sets in 30 sec., is ready for finishing after a minute. Price: $1200. *The DeVilbiss Co., 300 Phillips Ave., Toledo 1, Ohio.*

DeVilbiss gun sprays rigid urethane foam on vertical or overhead surfaces without sagging



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Plastics Applications Series:

Cellulosics, by *Walter D. Paist,* **Fluorocarbons,** by *Merritt A. Rudner,* and **Vinyl Resins,** by *W. Mayo Smith.*

Published in 1958 by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Respective pages: 270, 238, 282. Price: $5.75 each.

These handy little books follow the general pattern of the earlier ones of the Series.

"Cellulosics" opens with a 15-page resume, then goes on to chapters on chemistry, properties, and fabrication. The major part of the work describes applications in six principal areas: extruded and cast cellulosics, injected moldings, coatings, adhesives, fibers, and fabrics. Complete index.

"Fluorocarbons" opens with a few pages defining the resins in this family, then has a good chapter on their properties, including much data on the important filled TFE resins. The chapter on chemistry, like that in "Cellulosics," condenses most of the practical chemistry of these materials into a very small space. The longest chapter, which concerns TFE resins processing, is complete and clear, and includes data on the new Teflon 100X FEP resin. The chapter on processing TFCE resin suffers from being split up into little bits on the various commercial products. Another chapter discusses effects of fabrication on TFE resin properties. The remainder of the book is devoted to applications and a bibliography.

"Vinyl Resins" opens with a summary of production and consumption statistics, followed by a chapter on properties of the various vinyls. The chapter on chemistry is too brief to do justice to this large group of resins. There follows a chapter on manufacture and fabrication, limited to description of PVC and PVAc manufacture and PVC processing. A long chapter takes up applications of film and sheeting, foams, PVA, phonograph records, paints, tile, slush molding, plastisol compounding, saran uses, and others. A chapter on new developments treats the author's own PVC Pearls (M. PL., June, 1958, p. 131) at length. There is a 12-page index.—*J.F.C.*

Progress in Plastics 1957 (Papers and discussions at the British Plastics Convention)

Edited by P. Morgan

Published in 1958 by Philosophical Library, 15 E. 40th St., New York, N. Y. 394 pages. Price: $22.50.

This series contains information in 6 categories: polyolefin chemistry, structure, and properties; the same for polyethylene and PVC; extrusion; injection molding; recent developments in fluorine polymers and in thermosets; and analyses of properties of various reinforced plastics and their applicability to structures. Lots of new information here, and the level of quality is high—*J.F.C.*

Wood flour. Properties, uses, characteristics, facilities available from the firm, etc., regarding wood flour for the plastics, linoleum, and explosives industries. 4 pages. *Wilner Wood Products Co., Inc., Norway, Me.*

A Ready Reference for Plastics. A comprehensive nontechnical study concerning the commonly used plastics and their history; comparison of plastics; production methods; interchangeability of molds; machining of plastics; compatibility of plastics; a molder's organic chemistry of plastics; chemical origins; physical properties explained; designing pitfalls; and other valuable technical and engineering data. 134 pages. Up to four copies free on letterhead request. Over four, $2.00 each. (Available only to U.S. and territories). *Boonton Molding Co., 326 Myrtle Ave., Boonton, N. J.*

Plastics pipe. Advantages, applications, etc. of Kralastic, polyethylene, butyrate, PVC, and Chemweld plastics pipe. 4 pages. *Southwestern Plastic Pipe Co., P. O. Box 117, Mineral Wells, Texas.*

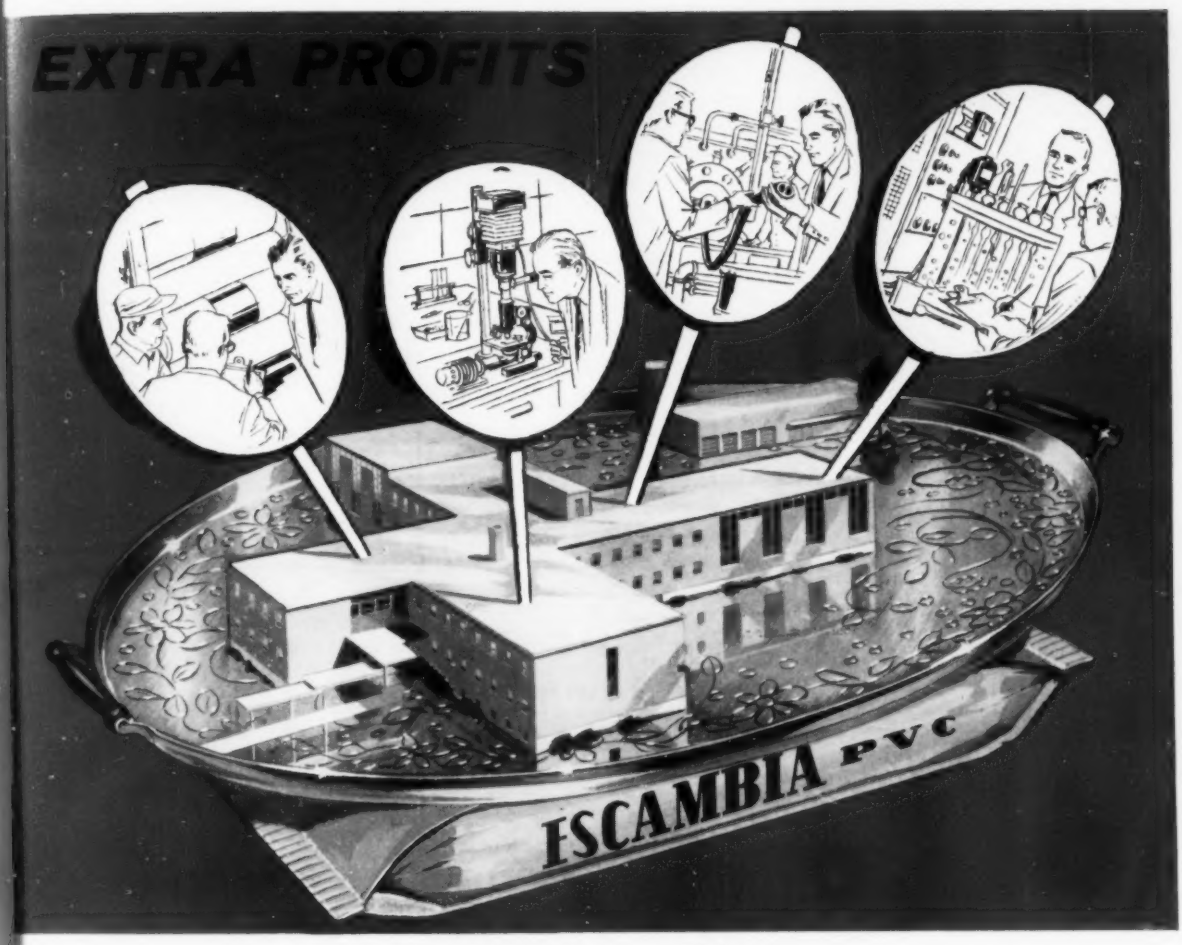
Epoxy compounds. Data on a family of Hysol 6040 compounds, including chart of three selected base resins showing comparative properties. TD Bulletin 6040-1. 3 pages. *Houghton Laboratories, Inc., Olean, N. Y.*

Yellowing preventive. Data on Yellow-Ban, a yellowing preventive that is added to thermoplastic and thermosetting molding compounds to retard yellowing during extrusion and molding. 1 page. *American Stearin Co., 520 Fifth Ave., New York 36, N. Y.*

Labels. "What Every Label User Should Know About Kleen-Stik Pressure-Sensitive Labels" gives applications, etc., for a line of removable and permanent labels. 12 pages. *Kleen-Stik Products, Inc., 7300 W. Wilson Ave., Chicago 31, Ill.*

Coatings. "Vacuum Metallizing Coatings for Metal, Glass, and Thermosetting Plastics" describes application procedures—mixing, hand or automatic spray, hot and electrostatic spray, flow and dip coating, baking cycles, etc. 16 pages. *Bee Chemical Co., 12933 S. Stony Island Ave., Chicago 33, Ill.*

Methyl butynol; methyl pentynol. Physical properties, applications, storage and handling, toxicity, methods of analysis, chemical properties, etc. for methyl butynol and methyl pentynol, two tertiary acetylenic alcohols used as solvents for vari-



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Polyurethane cushioning material. "The Development of a Non-Adhering Chemically Foamed-in-Place Polyurethane Cushioning Material for Packaging Purposes" describes a material that will not adhere to surfaces of packaging containers, molds, or packaged items. Developed by Air Force. Bulletin PB 131665. 22 pages. Price: 75 cents. *OTS, U. S. Department of Commerce, Washington 25, D. C.*

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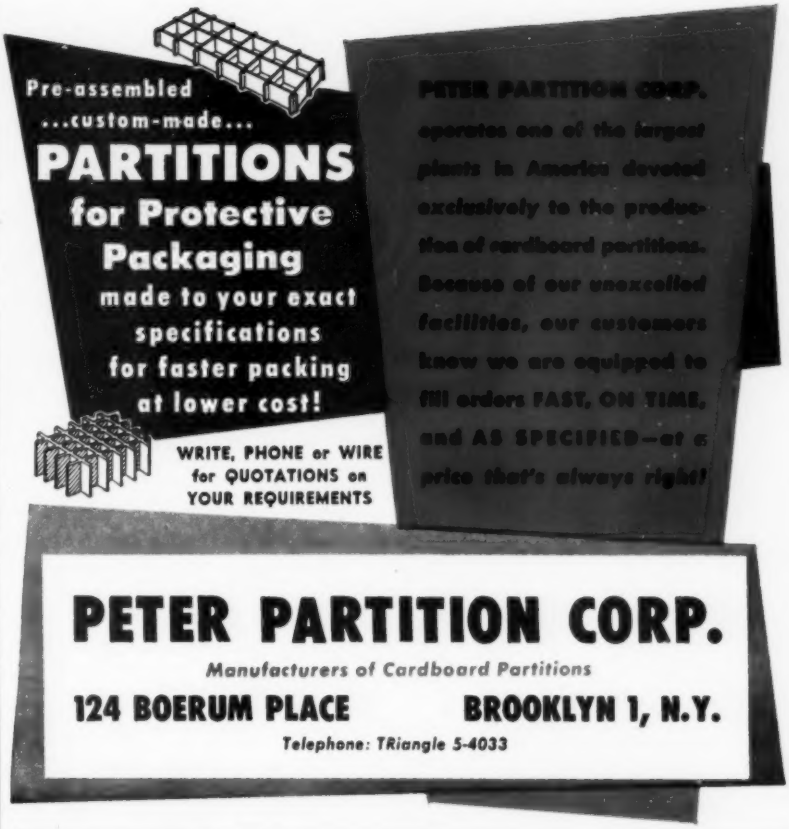
(*To page* 270)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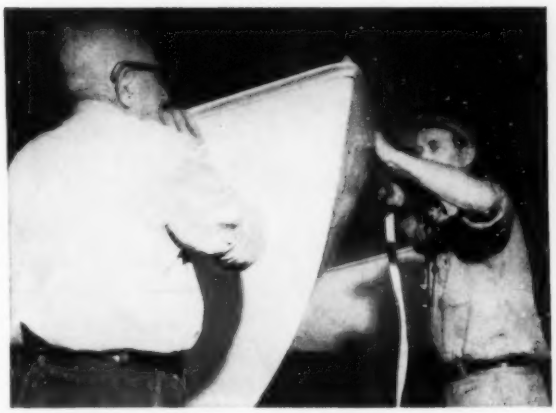

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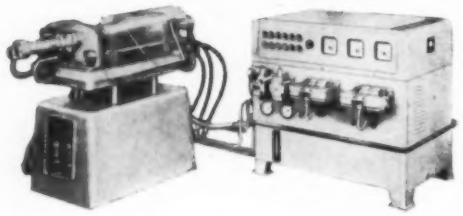

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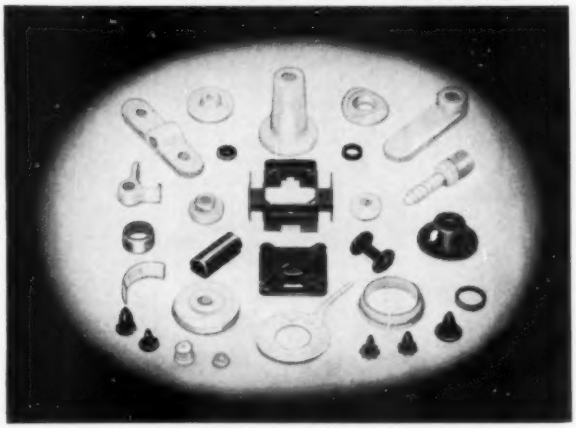

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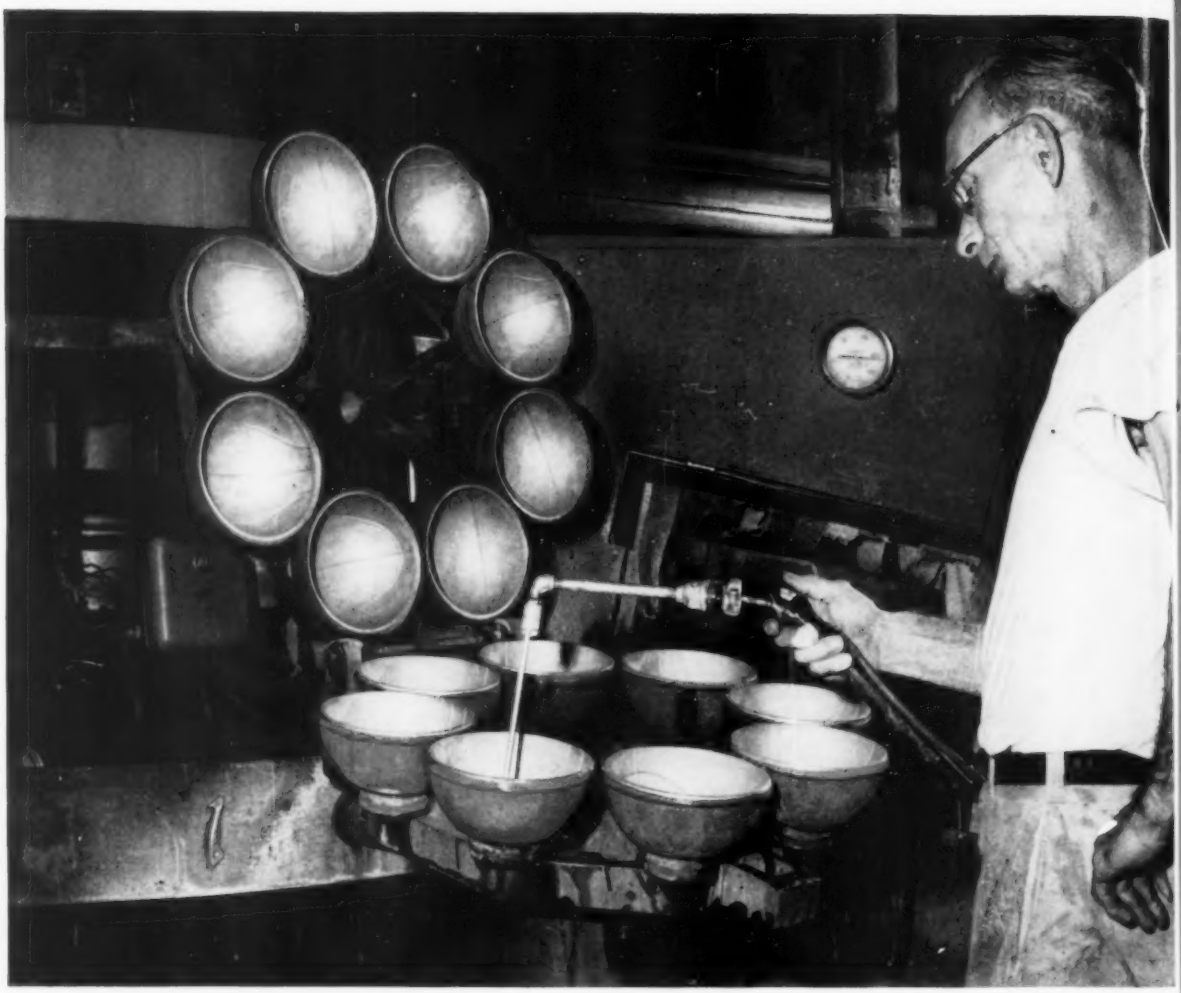

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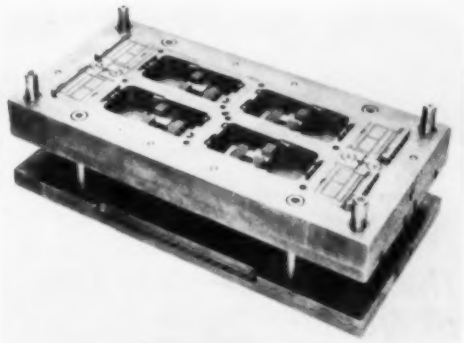

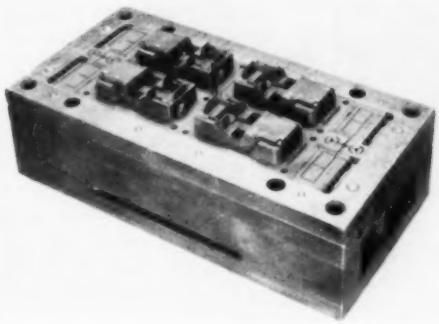

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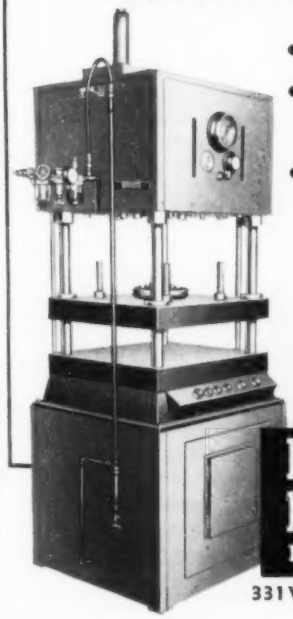

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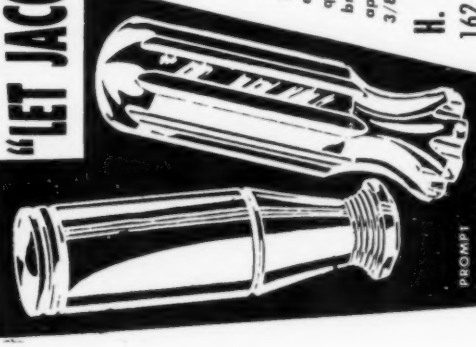

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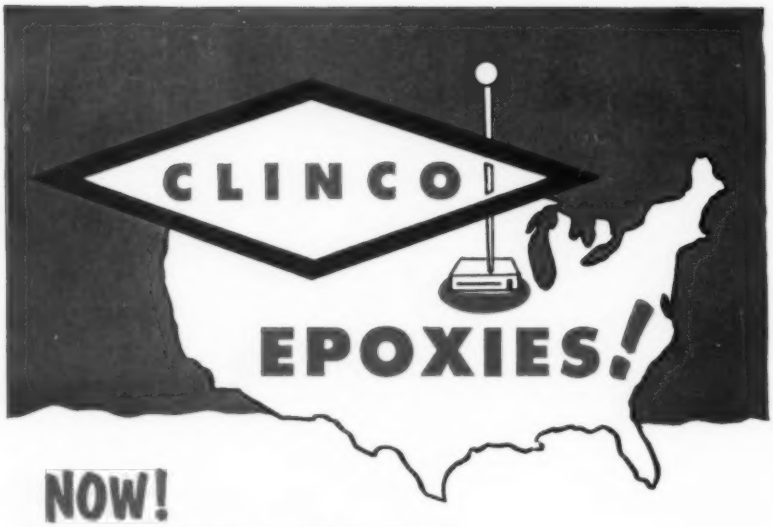

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plastics. Includes step-by-step photo story and a "before" and "after" sample. 4 pages. *Planet Plating Co., Inc., 494 Morgan Ave., Brooklyn 22, N. Y.*

Polyester film. "General Report on 'Scotchpak' Brand Heat Sealable Polyester Film for Packaging of Paint Colorants" gives physical properties and their reaction to normal and abnormal aging conditions, and other results of laboratory tests. 6 pages. *Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul 6, Minn.*

Polyurethane elastomer. Physical characteristics, applications, etc., for Duthane, a polyurethane elastomer combining certain attributes of plastics, rubber, and metal. 4 pages. *Dunlop Tire & Rubber Corp., Duthane Div., P. O. Box 2011, Buffalo 5, N. Y.*

Better Silage at Lower Cost. Describes how to build a silo with black Visqueen film. 4 pages. *Visking Co., Plastics Div., P. O. Box 1410, Terre Haute, Ind.*

Displays; decorations. Catalog showing extensive line of Christmas decorations, animated displays, architectural decor, and other advertising props made of thermoformed plastics. 8 pages. *W. L. Stensgaard & Assocs., Inc., 346 N. Justine St., Chicago 7, Ill.*

Molds and die bases. Specifications, general data, ordering instructions, prices, etc., for standard and special nested plastic molds and die bases. 7 pages. *Columbia Engineering Co., 113 Sussex Ave., Newark, N. J.*

Catalog of Technical Reports. Polystyrene (1930-58). 8 pages. Plastics, molded (1938-58). 4 pages. 10 cents each. *Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.*

Polyester resins. General descriptions, properties, storage conditions, methods of test, etc., for the following polyester resins: Self-extinguishing polyester resin SR.18995, Advance Information Sheet P.2, 3 pages; Polyester resin

(To page 280)

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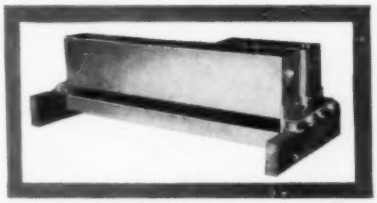

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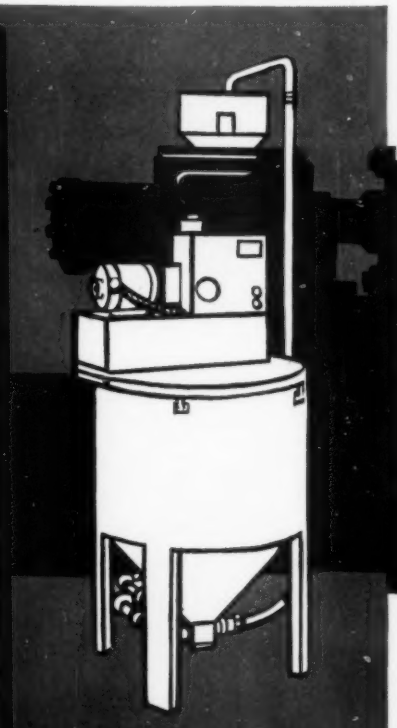

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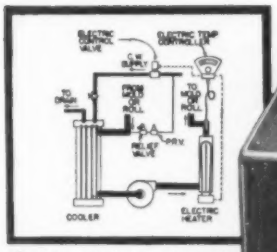

▲ Schematic diagram of control circuit in the Sarcotrol Model MC-1, Single Unit. Model MC-2, Dual Unit, is equipped with two of these circuits. Model MC-3 has three complete circuits.

Sarcotrol Model MC-2 Heating and Cooling Unit for injection molds, cylinders, rolls and drums. Fully enclosed. Easily seen, completely accessible control knobs. ▶

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PROCESSING OF "MOPLEN" *(No. 3 in a series)*

EXTRUSION — Extrusion is easily carried out by means of the conventional equipment employed for polyethylene (screw having 4:1 compression ratio and length equal to 18-20 times its diameter). As with polyethylene, care should be taken to follow the normal working methods to obtain good performance of the cooling and draw-down systems.

Wire covering — In covering wire, "MOPLEN" exhibits excellent electrical and mechanical properties, as well as high resistance to environmental cracking. The wire-covering process is not difficult, but care should be taken to cool slowly in blown air or, for some distance, in room temperature air and finally in water.

Pipes — Temperatures generally employed for pipe extrusion are:

190°—210°C (374—410°F)

Cool quickly with water as pipe emerges from the sizing die.

Sheeting — "MOPLEN" can be extruded in sheets of any thickness and color.

Films — Films can be obtained both by blowing and flat die processes. Approximate temperatures:

	flat die	blowing
Barrel	180°C (356°F)	170°C (338°F)
Nozzle	220°C (428°F)	200°C (392°F)

If fast cooling in water is employed, the gloss and transparency of flat die films are much superior to those shown by polyethylene and polypropylene blown and unquenched film. Rather slow cooling should be used for blown film.

Heat Sealing — "MOPLEN" film may be heat-sealed with the same equipment used for the welding of polyethylene film. Owing to "MOPLEN's" very low dissipation factor, high-frequency equipment should *not* be used.

Paper, cloth and aluminum coating — Use a flat die and lay the hot film immediately on the substrate (paper, cloth or aluminum sheet) using two rollers, one of rubber, the other of steel.

Filaments — Conventional methods (extrusion and hot drawing) can also be used with "MOPLEN." After drawing, the tensile strength of the filaments may equal that of the best monofilament obtained with other plastics.

Blown containers — Containers are made by the same method used for blowing polyethylene.

Temperatures

Barrel	175° to 185°C (347°—365°F)
Nozzle	210° to 230°C (410°—446°F)

Air injection — The air need not be heated, but the pressure should be increased progressively.

Note. In order to avoid the effects of prolonged heat above 200°C (392°F), the following working instructions should always be observed:

During both the extrusion and the injection molding, never exceed a given temperature limit. This varies, depending on the particular equipment and the speed of extrusion, but is usually of the order of about 270°C (518°F). Temperature of barrel should increase progressively from the hopper to the head. At the head, the temperature should be slightly reduced. In some cases, such as with large straight head extruders for film, it may be necessary to increase the temperature of the head somewhat.

For more detailed information about "MOPLEN," please write, outlining area of interest, to

Chemore Corporation
General Representative in U.S.A. and Canada for Montecatini
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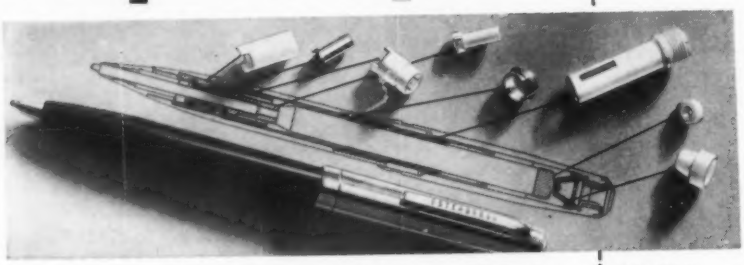

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SR. 19037, AIS P. 3, 3 pages; Self-extinguishing polyester resin DSR.19100, AIS P.5, 4 pages; Polyester resin DSR.19104, AIS P.6, 3 pages; Resin SR.19038, AIS P.7, 3 pages; Polyester resin DSR. 19098 for translucent rooflight sheet, AIS P.8, 4 pages; Self-extinguishing polyester resin DSR. 19046, AIS P.9, 4 pages; and Resin DSR.19105, AIS P.10, 4 pages. *Bakelite, Ltd., 12 Grosvenor Gardens, London, S.W. 1, England.*

Plastics for lighting. One of the most complete surveys ever published on the subject of plastics in building illumination, this reprint book contains copies of the papers delivered at the Fifth Meeting of the BRI Plastics Study Group held at the University of Houston, Houston, Texas, March 5-6, 1958. The papers cover such topics as selecting the right plastic for the desired lighting application; daylight control with plastics; prismatic control and diffusion control of electric light with plastics; luminous ceilings; new applications for plastics in building illumination; and future potential for plastics in lighting. The book is called "Plastics in Building Illumination." 100 pages. Price: $3.00. *The National Academy of Sciences, National Research Council, 2101 Constitution Ave., Washington, D. C.*

Plastic sheet forming. Recent developments and future possibilities for thermoplastic sheet forming are thoroughly covered in reprint book of papers originally presented at a special conference on "Formed Sheet Plastic for Packaging and Industrial Applications" held by AMA's Packaging Div. at the Hotel Commodore in New York on January 6-8, 1958. In addition to papers on each specific formable plastic, discussions covered such topics as continuous vacuum forming, pressure forming, air slip forming, visual packaging trends, skin packaging, forming refrigerator door liners, cost considerations, and the role of formed plastics in the world of tomorrow. 140 pages. Price: $3.75 for non-members. $2.50 for AMA members. *American Management Assoc., Inc., 1515 Broadway, New York, N. Y.*

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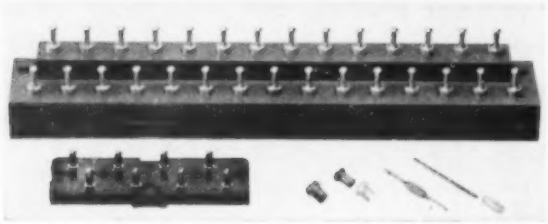

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mp Plastics

Production and sales figures in 1000 lb* for June and July 1958

Materials	Total p'd'n first 7 mos. of 1958‡	Total sales first 7 mos. of 1958‡
Cellulose plastics:[a]		
Cellulose acetate and mixed ester:		
Sheet, under 0.003 gage	10,203	9,899
Sheet, 0.003 gage and over	10,437	9,627
All other sheets, rods, tubes (including other cellulose plastics)	4,960	4,389
Molding, extrusion materials (including other cellulose plastics)	46,879	45,971
Nitrocellulose sheets, rods, tubes	1,827	2,000
Other cellulose plastics[c]	3,056	2,209
Phenolic and other tar-acid resins:		
Molding materials[a]	86,036	83,245
Bonding and adhesive resins for:		
Laminating (except plywood)	42,671	21,922
Coated and bonded abrasives	6,867	5,811
Friction materials (brake linings, clutch facings, etc.)	6,618	6,040
Thermal insulation	26,257	26,148
Plywood	27,551	23,003
All other bonding uses	20,604	20,574
Protective-coating resins	15,268	13,688
Resins for all other uses	16,385	12,582
Urea and melamine resins:		
Textile-treating resins	18,316	17,493
Paper-treating resins	14,427	12,559
Bonding and adhesive resins for:		
Plywood	50,195	72,061
All other bonding and adhesive uses, including laminating	22,884	20,835
Protective-coating resins	16,458	12,889
Resins for all other uses, including molding	50,023	48,345
Styrene resins:		
Molding materials[a]	229,231	245,882
Protective-coating resins	15,268	13,688
Resins for all other uses	85,898	68,682
Vinyl resins, total[b]	412,503	415,436
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for:		
Film (resin content)		40,017
Sheeting (resin content)		33,774
Molding and extrusion (resin content)		108,896
Textile and paper treating and coating (resin content)		31,361
Flooring (resin content)		61,363
Protective coatings (resin content)		17,083
All other uses (resin content)		29,886
All other vinyl resins for:		
Adhesives (resin content)		26,390
All other uses (resin content)		66,664
Coumarone-indene and petroleum polymer resins	131,239	130,576
Polyester resins:		
For reinforced plastics	57,961	52,418
For all other uses	6,658	6,171
Polyethylene resins total:	472,777	437,211
For film		174,743
For all other uses		262,388
Miscellaneous:		
Molding materials[a,d]	22,094	22,466
Protective-coating resins[e]	8,208	4,703
Resins for all other uses[f]	81,876	70,731

*Dry basis designated unless otherwise specified.
†Revised.
‡Partially estimated.
[a]Includes fillers, plasticizers, and extenders. [b]Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production are given. [c]Includes data for spreader and calendering-type resins.

Production

From statistics compiled by the U. S. Tariff Commission

June†		July†	
Production	Sales	Production	Sales
1,788	1,744	1,596	1,372
1,403	1,554	1,260	1,326
851	676	641	541
6,176	5,841	6,909	6,851
231	245	205	240
E	E	E	E
11,759	11,221	8,644	11,342
4,869	3,095	5,018	3,370
850	822	684	688
1,092	1,010	740	933
3,424	3,585	4,305	4,708
4,025	3,371	3,953	3,131
2,786	2,833	2,674	2,758
2,120	2,296	1,517	1,791
2,370	2,007	2,459	1,941
2,396	2,270	1,808	2,053
2,003	1,978	1,822	1,859
7,430	6,908	7,871	7,914
3,211	3,028	2,880	3,151
2,453	2,028	2,717	1,928
6,009	6,110	3,559	5,162
35,394	33,322	30,066	30,986
7,748	7,461	8,434	7,748
12,119	8,503	10,923	9,294
†57,986	†62,575	53,294	58,094
	5,986		4,771
	5,716		5,305
	16,205		15,420
	5,462		4,883
	9,117		8,078
	2,518		2,526
	4,020		3,860
	3,932		4,058
	†9,616		9,194
†18,117	†17,807	19,016	19,715
9,437	8,470	7,796	6,806
1,306	1,089	1,166	1,085
68,068	63,547	70,035	62,774
	23,489		24,684
	40,058		38,090
3,623	3,596	3,373	3,210
1,523	719	1,623	840
11,721	10,627	11,015	10,024

*Includes data for acrylic, nylon, and other molding materials. †Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins. ‡Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses. §This classification discontinued in May and this material, mostly vinyl cellulose, reported in sheets and molding material.

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Plastic Molds
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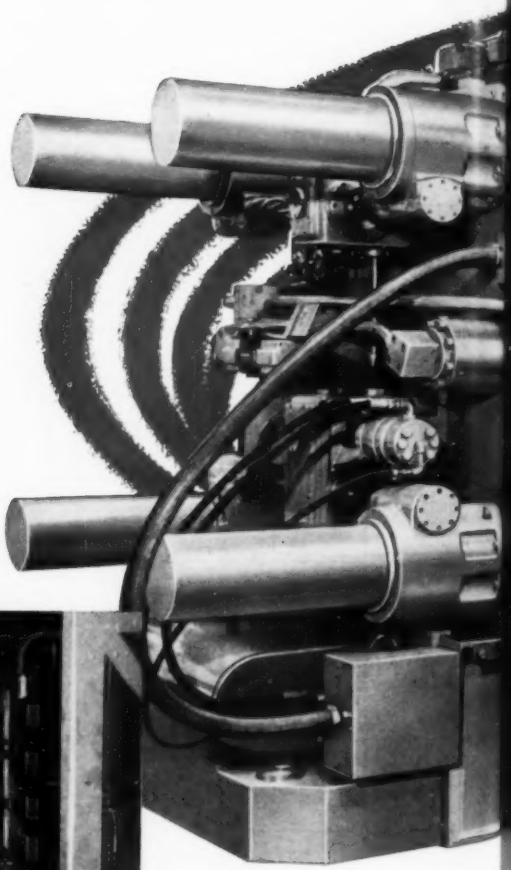
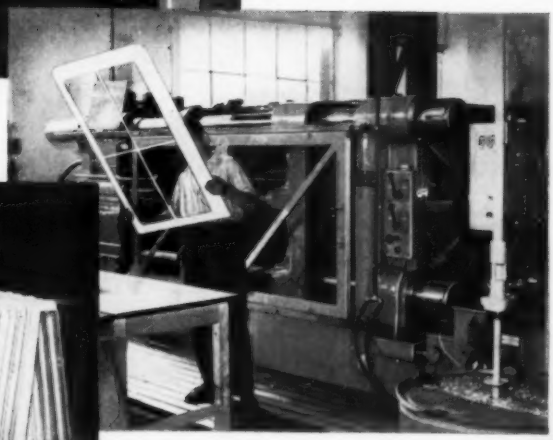


In spite of short floor to floor time, it is possible for the operator to crop, inspect and stack the moulded components between cycles.



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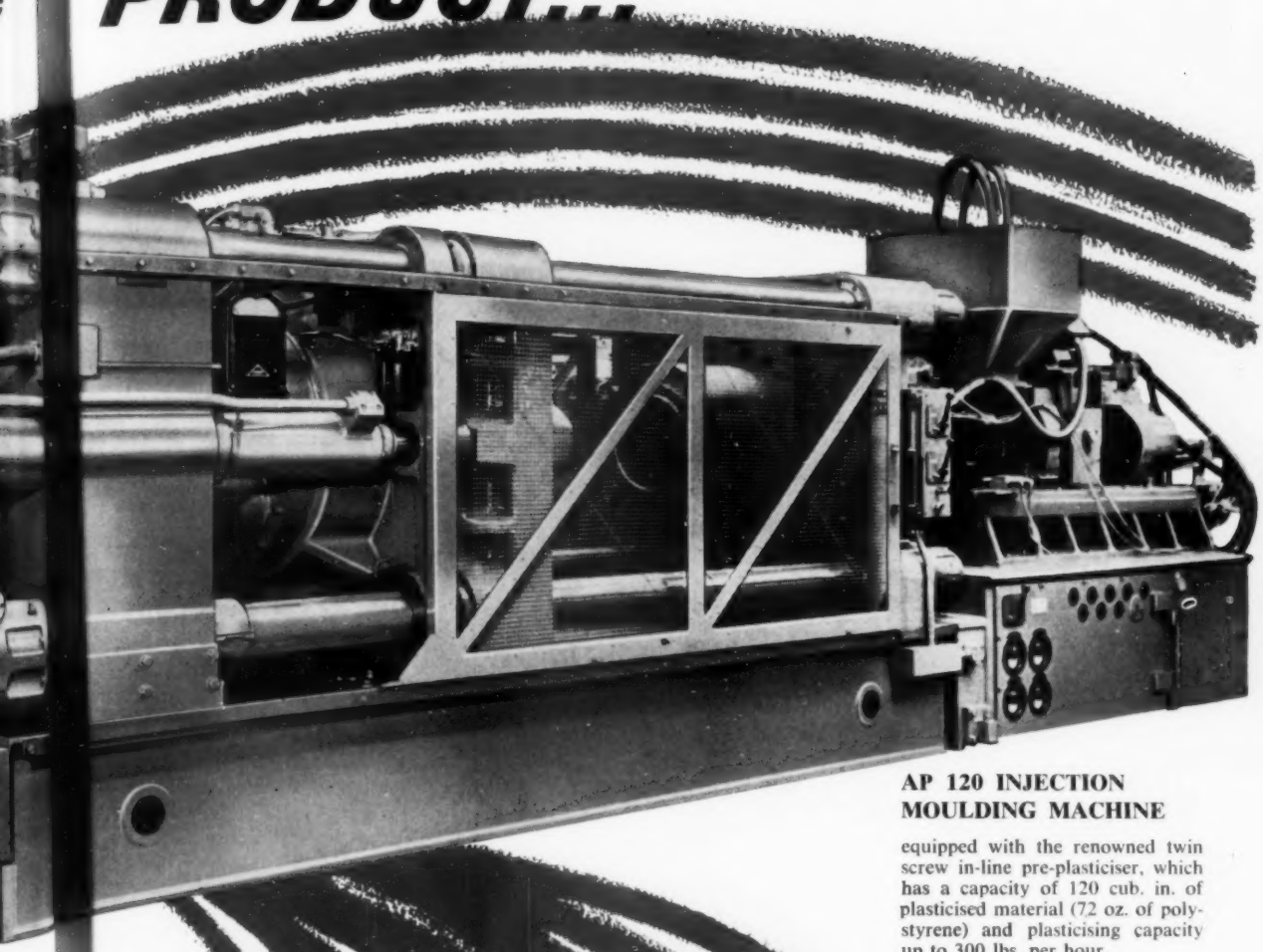

AP 120 INJECTION MOULDING MACHINE

equipped with the renowned twin screw in-line pre-plasticiser, which has a capacity of 120 cub. in. of plasticised material (72 oz. of polystyrene) and plasticising capacity up to 300 lbs. per hour.

Moulders throughout the world are turning to Windsors in ever increasing numbers; this is due in no small measure to the tremendous success achieved in the field by Windsor Automatic pre-plasticisers.

The photographs shown were taken at the plant of one of the many major companies in Germany using Windsor machines.

The Windsor range includes injection moulding machines in Capacities of from 1 to 240 ozs. and Extrusion machines with output up to 1,000 lbs. per hour.

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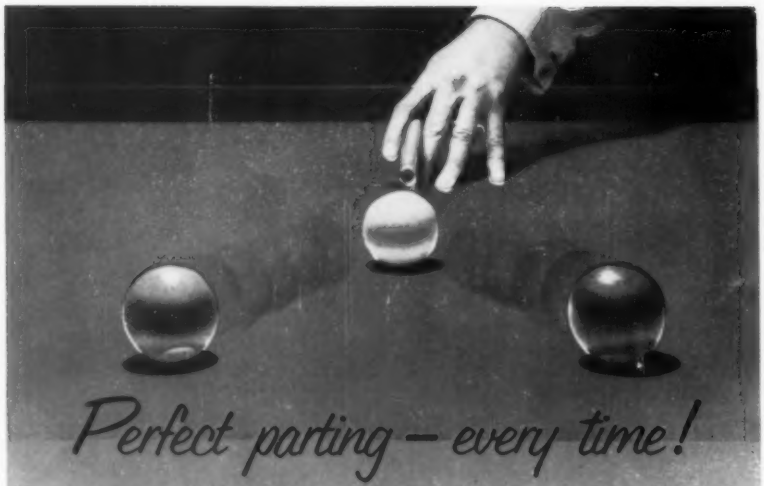

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Now, for the first time—truly practical 3-plate injection molding! NATIONAL'S *totally new* 3-plate mold set design and construction using Ball Bushings in the floating plate eliminates all possibilities of cocking or binding. The normal suction of mold parting causes the runner and cavity plates to open with ease—*automatically*—at the end of the molding cycle. This new concept of linear motion eliminates the need for troublesome mechanical assist devices such as latches and springs and brings to realization the full advantages of 3-plate injection molding.

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ALL NATIONAL "TRIPLATE FG" mold sets are equipped with precision BALL BUSHINGS combining the advantages of extremely low friction, long life and sustained alignment.

For full details write for **Bulletin 58-5, Dept. H**

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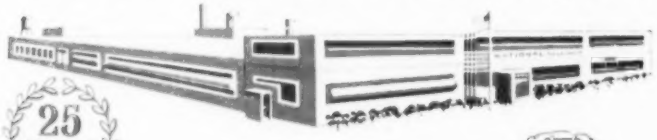

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2503

No backing board

A new transparent plastic skin packaging system in which a backing board is not required was demonstrated recently by Eastman Chemical Products, Inc., on a packaging machine made by Washington Steel Products, Inc., Tacoma, Wash.

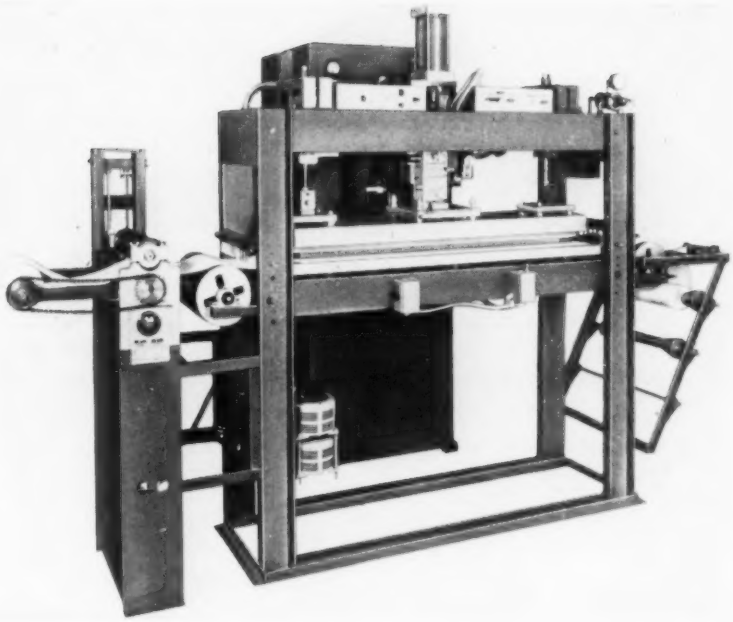
In the new system, Eastman's butyrate film is heated to forming temperature and then "draped" over the article being packaged. Vacuum is then applied, which draws the softened, roll-fed film down over the sides and under the bottom edges of the article, thus almost completely enclosing it in a transparent plastic cover. The unformed part of the sheet becomes a semi-rigid flat surface which can be perforated for separating packaged units.

In addition to the savings in materials costs, elimination of the backing board makes labor savings possible, since there is no necessity for subsequent assembly operations. Long package life can be expected, because butyrate is highly resistant to aging; and elimination of the backing board prevents problems of warpage.

The butyrate film used in the demonstration is 7½ mils thick, supplied in rolls 21½ in. wide. Total vacuum forming surface of the machine is 20 by 24 in., floor space required is only 5 by 6 feet.

Eastman feels the new system will find wide use in the packaging of such products as hardware (as the drawer pull and attaching screws shown below), lipstick, pill boxes, and many more similar items.—END

Cosmos Roller Feed with three cylinder press for equal pressure and level on long seals.



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Find out why more than 90% of our customers have switched to COSMOS HEATSEALERS featuring exclusive COSMOCHROME

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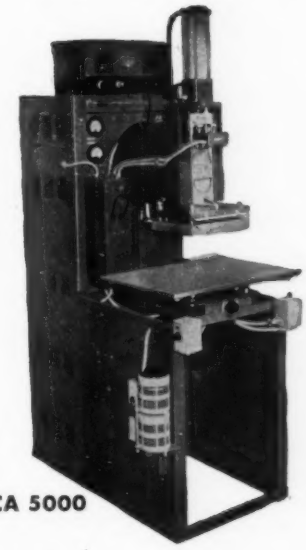

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Cosmos heatsealers offer more versatility and more working power than others with the same rating. The new Cosmos performs any standard operation PLUS sealing edges and 3D appliques in several colors . . . ALL IN ONE OPERATION!!

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INTERPLASTICS NEWS LETTER

NATIONAL PLASTICS EXPOSITION: We will be at Booth #632 at the Chicago International Amphitheater, November 17th to 21st. We cordially invite you to stop by and meet us.

We will be pleased to send you rapid registration cards upon request.

In the past several months, we have informed thermoplastics processors and manufacturers of the variety of materials we can offer. The Plastics Show will give us an opportunity to show you samples, molded and extruded from our materials and to give you whatever information you might wish.

We are sure that a talk with us about your material requirements will result in savings on your raw material costs.

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POLYETHYLENE: Low, intermediate, high density. Natural, colors, special effects. Intermediate density mixtures compounded to order.

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CELLULOSICS: Cellulose acetate, virgin and reprocessed, compounded to order. Also Butyrate and Ethyl Cellulose.

Our business is the distribution and marketing of the above thermoplastics materials and others, both on a continuous supply and on a spot basis. We also buy surplus inventories, off-specification resins and scrap. It will pay you to contact us.

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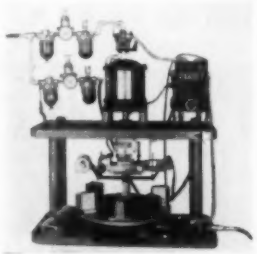
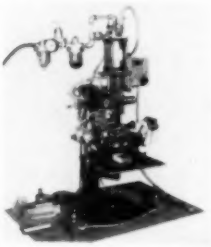
Model 6-EA (electro-air) Index. Complete automatic indexing press. Weber four-post construction for zero deflection. Up to 75 impressions per minute. Indexing tables from 10" to 48" diameter.





Model H-EA. A popular press for light work. Takes plastic parts up to 24" high. For stamping with dies or type. Furnished with electrically heated type holder.

Model 6-EA. For marking large parts, either molded or vacuum formed. Built in all widths and depths with no limit on height or depth between posts. Weber four-post open frame construction and direct thrust air operation assure precision decorating even when parts are not uniform.

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PANAFLEX BN-1 is a hydrocarbon secondary plasticizer for vinyls. It is a clear, light straw-colored liquid, compatible with vinyl chloride polymers and copolymers. It formulates readily with primary plasticizers, pigments, stabilizers and other ingredients. Color stability and volatility compare favorably with other hydrocarbon-type plasticizers. Its specific gravity is only 0.946.

In large-volume compounding for extrusions, a few cents saved per pound of compound makes a big difference in profits. PANAFLEX BN-1 can help you widen your margin of profit by reducing your compound costs. You'll get a good-quality finished product plus, in some instances, improved processing.

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General Mills

MINNEAPOLIS, MINNESOTA

Disposable razor molded of styrene

The one-time use, disposable shaving kit has arrived, and plastics made it possible. Key to the throw-away kit is a molded styrene safety razor with a built-in blade.

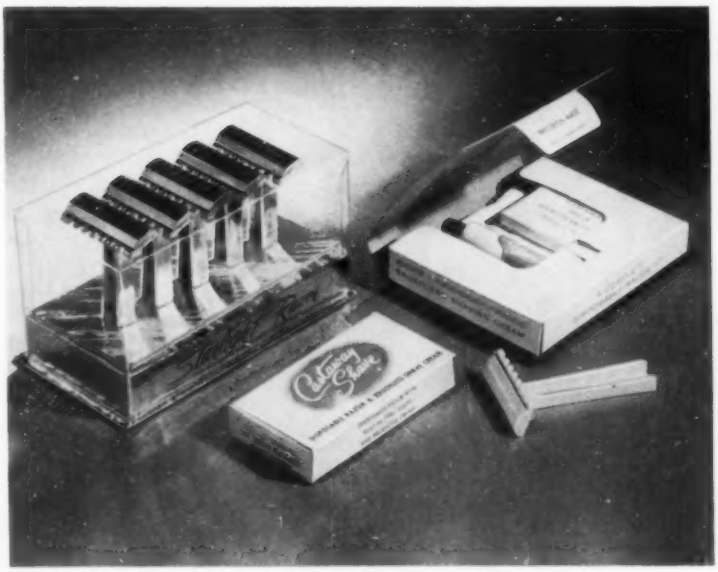
The razor, inexpensive enough to be thrown away after one shave, is a boon to travelers, who often forget to pack a razor, or have to put it away wet after the morning shave. It can also add a note of hospitality in the guest room. Its one-time use feature has made the razor attractive in hospital application, where it reduces danger of infection without cumbersome sterilization procedures.

The product is manufactured by Rochester Razor, Inc., Rochester, N. Y., of Monsanto's Lustrex styrene. The combination of low cost, ease of molding, and surface gloss makes styrene an excellent choice of material for the razor. In use, the razor is almost nick-proof, according to the manufacturer, and danger of cut fingers is eliminated because the blade never has to be handled.

The disposable razor is being marketed in three ways. In the Castaway Shave Kit, it is combined with enough brushless shaving cream for one shave. The kit is smaller than a pack of cigarettes and will fit conveniently into a pocket or briefcase. These kits are now being installed in 7500 vending machines at transportation terminals across the country, with a price of 25 cents. For retail outlets, the kits are packaged 24 to a display box. A more complete kit with the same razor contains face soap and a towel as well.

For the guest room, the razor is produced in pastels or gold colored styrene and packaged attractively in sets of five. Distribution is through drug and cosmetic counters. Retail price for a set of five is $1.50 in gold styrene and 98¢ in a choice of pastel colors.

For use in hospital pre-operative procedures, the razors are machine packaged in individual sanitized envelopes under the name Disposo Razor. Discarded after each use, the razors cannot spread infection.—END



Throw-away razors, molded of styrene, have a built-in blade that is claimed virtually nick-proof. They are marketed in Castaway Shave (center), a kit smaller than a pack of cigarettes containing razor and shave cream, a larger disposable kit that also holds soap and towel (right), and a five-razor set for the guest room in a transparent container (right). Razor at right shows one-piece molded plastic construction, with the precision blade already inserted in slot

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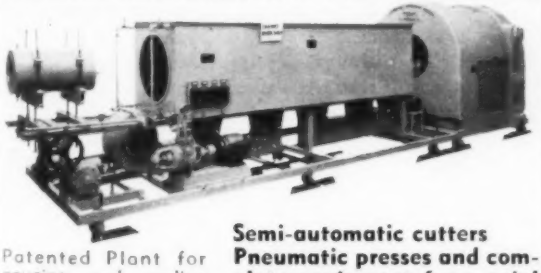

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non-migratory
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excellent dry blending
good low temperature properties
can be used as sole plasticizer

physical data

100% Modulus	1320 psi
Tensile Strength	2695 psi
Elongation	338%
Hardness, Shore A	80
T_f	—17.3°C.
Flux Time	45 seconds

heat stability (180°C.)

Initial Discoloration	15 min.
Maximum Discoloration	90 min.

extraction loss

Water	0.21%
1% Soap	3.45%
Mineral Oil	2.10%

migration

Lacquer, 25°C., 14 days	Very slight softening
Varnish, 25°C., 14 days	No effect
Polystyrene, 60°C., 19 days	No effect

Harflex 325 polymeric plasticizer

economical
non-migratory, permanent

Both these Polymerics are used with Vinyl Chloride Polymers and Copolymers, Polyvinyl Acetate, Synthetic Rubbers, Nitrocellulose, Cellulose Acetobutyrate, and Polymethyl Methacrylate.

physical data

100% Modulus	1320 psi
Tensile Strength	2471 psi
Elongation	350%
Hardness, Shore A	76
T_f	—12.5°C.
Flux Time	60 seconds

heat stability (180°C.)

Initial Discoloration	15 min.
Maximum Discoloration	90 min.

extraction loss

1% Soap	2.6%
Mineral Oil	1.2%

migration

Lacquer, 25°C., 14 days	Slight staining, very slight softening
Varnish, 25°C., 14 days	Slight staining
Polystyrene, 60°C., 19 days	No effect

Harchem produces a full line of phthalate, adipate, sebacate and polymeric plasticizers in addition to the plasticizers shown.

The Harchem Division laboratories will gladly assist you with your plasticizer problems, or will supply additional data including formulation test methods and formulation suggestions for any Harflex Plasticizer.

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NEWS FOR RESIN USERS. 28-page bulletin contains articles on a new post-stabilizer for natural and synthetic resins, a new acrylic coating resin with improved hardness and adhesion, the use of ion exchange in gelatin processing, etc. Resinous Prod. Div., Rohm & Haas Co. **(K-802)**

FLOW PROPERTIES MEASURER. Bulletin discusses versatile, heavy-duty instrument for recording flow properties of plastics. Describes its use in the carbon brush and electrodes industries. C. W. Brabender Instruments, Inc. **(K-803)**

GRANULATORS. Illustrated brochure lists features and specifications of a line of high-based, all-steel granulators designed to handle all thermoplastic materials from .001-in. film to 11-in. solids. Alsteele Engineering Works, Inc. **(K-804)**

ELECTRIC HEATERS. Illustrated booklet presents 25 case studies describing the uses and advantages of "Chromalox" strip, ring, tubular and cartridge heating elements in plastic processing. Edwin L. Wiegand Co. **(K-805)**

INJECTION MOLDING MACHINE. Illustrated data sheets describe features of an automatic 2½-oz. horizontal plastics injection machine that plasticizes up to 30 lbs./hr. Includes specifications, price. The Van Dorn Iron Works Co. **(K-806)**

CONVERTING MACHINERY. Illustrated 24-page booklet describes lines of plastics processing machinery. Includes coaters, laminators, slitter-rewinders, winders, printing presses, embossers, etc., Dilts Div., Black-Clawson Co. **(K-807)**

SMALL INJECTION MACHINES. Illustrated brochure describes line of high-speed, automatic injection machines with capacities under 8 oz. Also describes "Duplimatic" machine for cord plug and insert molding. Moslo Machine Co. **(K-808)**

CHEMICALS FOR PLASTICS. 16-page catalog describes and gives uses for this company's line of industrial chemicals. Includes tar acids and oils, plasticizers, "CUMAR" Resins, maleic anhydride, fumaric acid, etc. Plastic and Coal Chem. Div., Allied Chemical Corp. **(K-809)**

VARIABLE SPEED MACHINE DRIVES. 12-page illustrated booklet describes features of "Reflect-A-Spede" drives for powering extruders, calenders, laminators, and slitters rewinders at precisely-controlled speeds. The Louis Allis Co. **(K-810)**

EPOXY AND POLYESTER PASTES. Separate booklets display color chips, discuss features and list prices for epoxy and polyester resin color pastes. Plastic Color Co. **(K-811)**

PORTABLE PLASTIC MOLDER. Illustrated brochure describes an 88-lb. molding machine that works with all types of thermoplastics, including nylon. Has ½-oz. or ¾-oz. shot capacity; production rate from 1 to 6 cycles/min. Unex Labs. Div., Nichols & Clark. **(K-812)**

LAMINATES. Illustrated folder describes the features and manufacture of clad and unclad phenolic laminates for the electrical and electronics industries. Lists available grades together with their characteristics. New England Laminates Co., Inc. **(K-813)**

METALIZED PLASTICS. 4-page illustrated brochure describes techniques and applications of the barrel plating process for metalizing small plastics products such as toys, buttons, jewelry, hardware, etc. Planet Plating Co., Inc. **(K-814)**

PROCESSING MACHINERY. 4-page folder describes this company's pull-off unit, layflat tubing haul-off and surface winder, and constant tension turret winder. Faeco Machine Co., Inc. **(K-815)**

REINFORCED MOLDING COMPOUNDS. Brochure describes line of premixed thermosetting fibre reinforced molding compounds containing polyester resins, fillers, pigments and fibres. Woodall Industries, Inc. **(K-816)**

ORGANIC PEROXIDES. Technical bulletins list specifications, properties, analyses, uses, storage and handling information, etc., for the Cadet Chemical Corporation's organic peroxides. Chem. Dept., McKesson & Robbins. **(K-817)**

EPOXY METERING SYSTEMS. Illustrated brochure describes systems designed for proportional metering, mixing and metered dispensing of two-component reactive liquid resins of viscosities up to 500,000 cps at room temperature. Mitchell Specialty Div., Industrial Enterprises, Inc. **(K-818)**

LAMINATED PLASTICS. Illustrated booklet describes this company's experience and facilities for fabricating laminated plastics and vulcanized fibre parts. Taylor Fibre Co. **(K-819)**

MOLD RELEASE SPRAYS. Folder lists lines of aerosol mold release and anti-rust sprays. Gives features, prices of a paintable silicone, a zinc stearate dry powder spray, a neutral oil spray for polyethylene, etc. Injection Molders Supply Co. **(K-820)**

FOAMED PLASTIC. 28-page illustrated brochure describes structural, electronic and thermal insulation uses of "Nopco Lockfoam", a family of gas-expanded foamed plastics. Gives handling techniques, physical properties. Nopco Chemical Co. **(K-821)**

LIFT TRUCKS. Illustrated brochure describes lift trucks capable of lifting and moving every type of load up to 2,000 lbs. Trucks have 180° steering arc., weigh about 2,000 lbs. John Morrell Mfg. Co. **(K-822)**

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PERODIDIC CATALYST. Technical bulletin discusses the application of cumene hydroperoxide for curing polyester resins. The catalyst's advantages include ease of handling and versatile applicability. Naval Stores Dept., Hercules Powder Co. **(K-824)**

MOLD RELEASE AGENT. Handbook describes advantages of this company's release agent in compression molding, resin potting and plastic casting, cold molded plastics, machining of plastics, etc. Price Driscoll Corp. **(K-825)**

INJECTION MOLDING ACETATE, BUTYRATE. 51-page technical manual discusses the design, injection molding, and finishing of this company's "Tenite" acetate and butyrate. Eastman Chemical Products, Inc. **(K-826)**

SPRAY DECORATING EQUIPMENT. File folder contains illustrated literature on electroformed spray painting masks, several automatic spray painting machines, an automatic rotary wiping machine and a mask washing machine. Conforming Matrix Corp. **(K-827)**

POLYETHYLENE RESIN. 56-page manual discusses the properties, uses, injection molding and extrusion techniques, and fabricating operations involved in the manufacture of products from "Alathon" polyethylene resin. Polychemicals Dept., du Pont de Nemours & Co., Inc. **(K-828)**

VACUUM METALIZING COATINGS. 16-page brochure describes procedures for applying vacuum metaling coatings to thermosetting plastics by hand or automatic spray, hot spray, electrostatic spray, and flow and dip coating. Bee Chemical Co. **(K-829)**

INJECTION MACHINES. Illustrated brochure describes a line of 16 to 20-oz. hydraulic machines with a plasticizing rate of 150 lbs./hr. and a maximum mold size of 23¾ in. by 36 in. Lombard Governor Corp. **(K-830)**

OXO ALCOHOLS. 23-page technical bulletin discusses properties and behavior characteristics of octyl and dectyl alcohols, and their role in the production of ester plasticizers. Enjay Company, Inc. **(K-831)**

REINFORCED FIBER GLASS. 20-page illustrated brochure describes this company's design-to-production service for plastic reinforced fiber glass products. Industrial Products Div., The General Tire & Rubber Co. **(K-832)**

PLASTICIZER STUDY. 11-page compounding study evaluates properties of primary and secondary plasticizers used with this company's "Pliovic AO" plastisols. Chem. Div., The Goodyear Tire & Rubber Company. **(K-833)**

REINFORCED PLASTICS MOLDING PRESSES. Illustrated 7-page brochure describes 100-, 150- and 200-ton presses with maximum mold spaces 48 in. by 36 in., 60 in. by 48 in. and 84 in. by 60 in., respectively. The Hydraulic Press Mfg. Co. **(K-834)**

COLORED POLYESTER COMPOUNDS. 5-page illustrated bulletin describes available multi-colored thermosetting polyester molding compounds. Discusses molding procedures, curing time, fabricating, shelf life, etc. Durez Plastics Div., Hooker Chemical Corp. **(K-835)**

SILICA IN PLASTICS. 7-page bulletin describes colloidal silica as a thixotropic agent in polyesters and epoxy resins, in plastisols and organisols, and as a gelling agent in plastigels. Minerals & Chemicals Div., Godfrey L. Cabot, Inc. **(K-836)**

SURFACE PYROMETERS. Illustrated 12-page bulletin describes line of thermoelectric instruments for indicating the temperature of flat and curved surfaces, and sub-surfaces of materials in a plastic or semi-plastic state. Cambridge Instrument Co., Inc. **(K-837)**

PLASTICS HEAT SEALER. Illustrated bulletin describes an automatic machine that seals polyethylene and other thermoplastic parts up to 8 in. in diameter and 8 in. in length, without the use of adhesives. Cosom Engineering Corp. **(K-838)**

INFRA-RED OVENS. Illustrated brochure describes a line of fused quartz electric radiant ovens designed for forming plastics. Corrosion and acid-resistant units provide heat up to 1,500°F. The Cleveland Process Co. **(K-839)**

VINYL INKS. 5-page bulletin describes properties of a line of gravure inks for the multicolor printing of vinyl film, sheeting and coated fabrics. Claremont Pigment Dispersion Corp. **(K-840)**

GRANULATORS. 4-page illustrated brochure describes a line of all-steel, beside the press and batch granulators with capacities up to 400 lbs./hr. Ball & Jewell, Inc. **(K-841)**

ANTI-STATIC COMPOUND. Technical bulletin describes paste, cream, liquid and liquid concentrate forms of a coating compound for neutralizing positive and negative charges on the surfaces of plastic materials. Optics Manufacturing Corp. **(K-842)**

WOOD FLOUR FILLER. Illustrated brochure describes production and features of Eastern White Pine wood flour as a filler in the manufacture of vinyl flooring and other plastic products. Includes specifications. Wilner Wood Products Co. **(K-843)**

MOLDING MACHINES. 12-page illustrated brochure describes this company's 2- to 3-oz., 4- to 6-oz., 12-oz., and 28- to 32-oz. horizontal machines; its 1½- to 3-oz., 4- to 6-oz., 16- to 22-oz., and 32- to 48-oz. vertical machines; and its 50-, 175-, and 350-ton transfer presses. Improved Machinery, Inc. **(K-844)**

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- LOWER INITIAL AND AGED VISCOSITIES IN PLASTISOLS AND ORGANOSOLS
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Portable adding machine, roughly the size of a telephone, has housing of methylstyrene-acrylonitrile

Midget adding machine

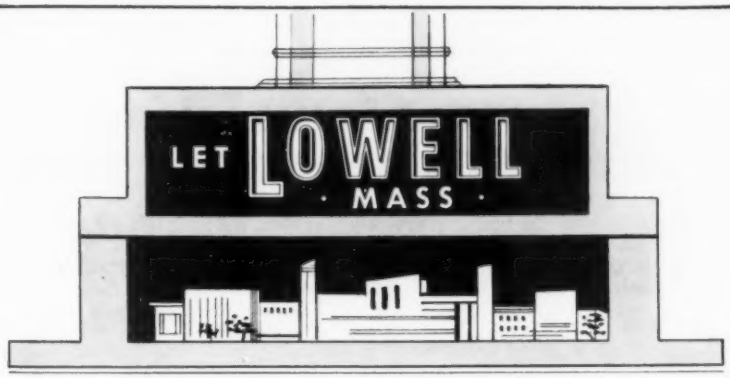
A lightweight yet durable midget electric adding machine that is finding increased use in the office as well as in the home was designed to take advantage of the weight and strength properties of several plastics.

Produced by Underwood Corp. and tradenamed Add-Mate, the machine has a two-toned, two-piece housing molded of American Cyanamid's Cymac 201 methylstyrene-acrylonitrile copolymer, selected because of its toughness, surface hardness, resistance to heat and stains, and substantial cost savings over metal. In addition, it does not soften or discolor from contact with the permanent lubrication applied to the internal mechanism prior to assembly in the housing or with cleaners.

The two-piece housing, as well as the transparent, serrated tear plate (also of Cymac 201), are injection molded for Underwood by Nosco Plastics, Inc., Erie, Pa. Keys are molded of Eastman Chemical's Tenite. And nylon gears, cams, etc., are also used.

Assembly blocks in the cover and the base tray, as well as the tear plate, are cemented in place. Other parts are fastened with screws, nuts, and rivets.

Measuring 5 in. high, 7 in. wide, and 9 in. long, and weighing 7½ lb., the Add-Mate comes in a choice of molded-in colors, and, with a luggage-type carrying case, retails for $168.50.—END



Mould your New Plant . . . Precision Perfect

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Lowell offers the plastics manufacturer: industrially zoned, prepared sites; 1,000,000 gallons of water; ample waste disposal; railroad sidings; modern highway connections.

Ask about Lowell Community Compact.

Contact: William J. Farrell, Executive Director,

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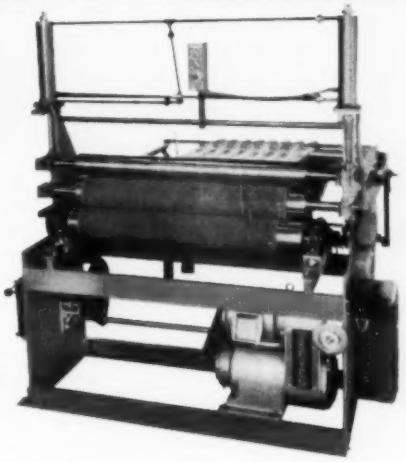
FAECO

Processing Equipment



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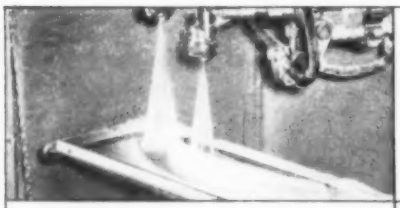
Cut masking time and costs to a fraction

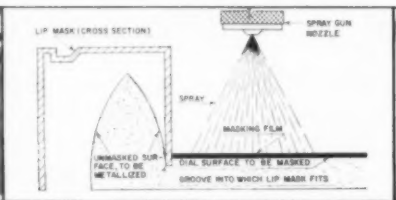
SIMPLE DESIGN FEATURE ALLOWS
AUTOMATIC SPRAY-ON, STRIP-OFF MASKING

A simple design feature incorporated into your molded plastic parts—a ridge or groove to separate masked from unmasked areas—lets you take advantage of a revolutionary new automatic masking process. The mask—Spraylat SC-1075 — is a liquefied compound that sprays on areas to be shielded, dries to form a tough protective film, and peels off when decorating is complete.

IT'S SO FAST, a single unskilled operator can mask over 200 of your most complex parts per hour for decorating or metallizing. The diagram shows how. The ridge or groove permits a metal lip mask to be fitted to the part, shielding from spray the areas where decorating should take. One lip mask—easily made from your part or mold pattern — is all that's required.



A complex speedometer dial is masked for metallizing in less than 5 seconds. Spraylat coating is sprayed onto dial face through window of stainless steel lip mask.



The secret is the groove around rim of dial face into which lip mask fits snugly. This gives razor-sharp break between masked areas (to remain clear) and unmasked portions (to be metallized.)

Mask of Spraylat coating is peeled off dial after it has been enamelled and metallized.

For help or suggestions in designing your product to take advantage of this money-saving process, write:

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- Heat and air circulation maintained between color impressions.
- High temperature oven sets coatings.
- Tachometers at all critical work stations for stress-saving mechanical coordination.
- Equipped with choice of selective power or conventional drives.
- Available with hydraulic printing nip pressures to permit simultaneous backing away of all nips.
- Indexing units allow printing of narrower width film with simple indexing of impression roller.
- Machines available up to 6 color in gravure.
- New variable tension controller and aluminum slat expanders, also available as optional equipment.

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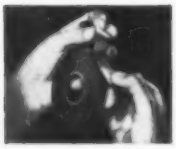

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Patapar Releasing Parchments show excellent performance in processes involving synthetic rubber, polyurethane foams, polyesters, vinyl, organic adhesives, organosols, phenolics, acrylics.

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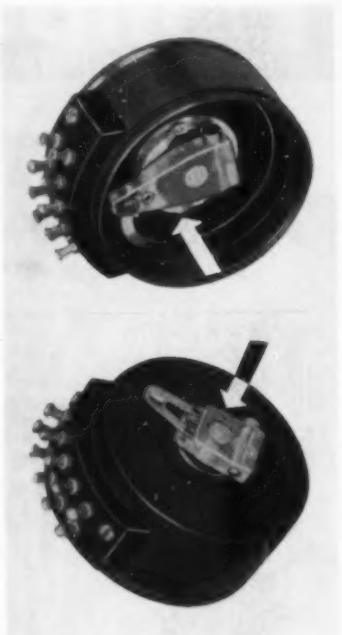
Fluorocarbon cuts cost

A saving of over 50% in material costs of precision potentiometer parts was achieved through the use of Kel-F trifluorochloroethylene (TFCE) resin (Minnesota Mining & Mfg. Co.) for two molded parts and for wire insulation in a line of variable resistors. These potentiometers ("pots"), made by Micro-Lectric, Roosevelt, N. Y., are used for measuring and comparing voltages in aircraft simulators and computers. By switching from costly parts—assembled from several materials and protectively plated—to TFCE moldings, the maker reduced not only the cost but also the weights of these parts by one ounce each. Since the shafts must accelerate very rapidly in use, this reduction in weight—and inertia—means faster response. Dielectric strength is better, too. Because of this, wire insulation can be thinner, making wire bundles less bulky. In this case, the wiring also had to withstand soldering temperatures up to 450° F. The TFCE-coated wire proved to be about half as costly as the best competitive wire.—END



Fluorocarbon parts (arrows) in potentiometer reduce costs and permit important weight savings

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No matter what your mold requirements may be, you can trust your job to Midland. For here are patternd skilled craftsmen, the country's finest facilities and experience second to none. Molds from electrical parts to refrigerator doors, hobbed cavities from toothpaste tube caps to tractor cabinets are all within Midland's capacity . . . for here is the world's largest hobbing press, tripling furnace hobbed cavity limits. But that's not all . . .
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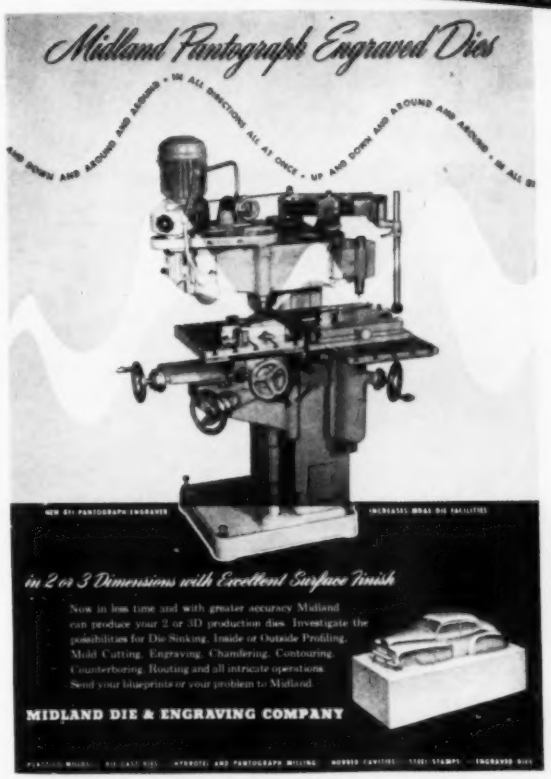
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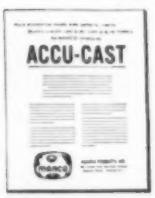

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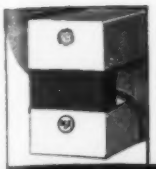

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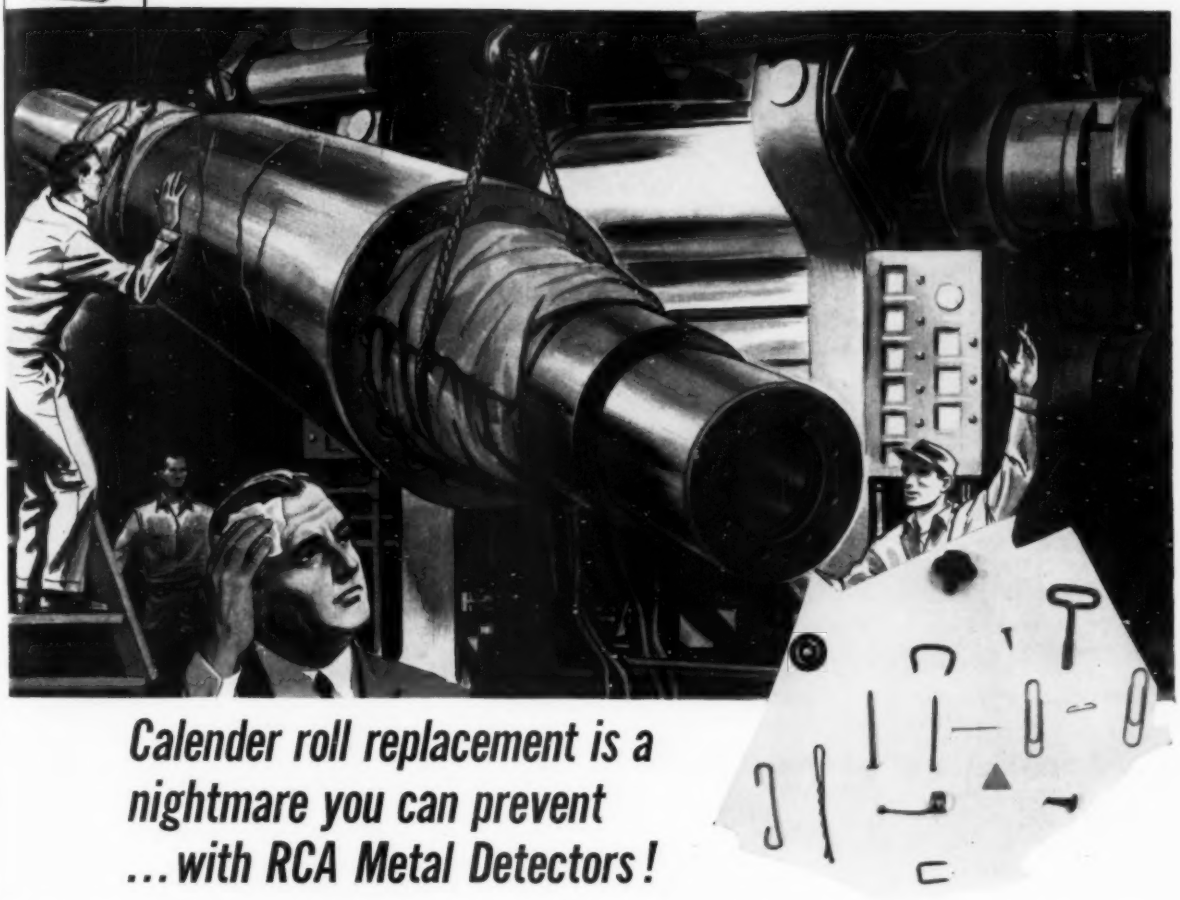

Calender roll replacement is a nightmare you can prevent ...with RCA Metal Detectors!

If the above picture was only a "bad dream," it wouldn't be worth discussing. Unfortunately, tramp metal damage to calenders DOES cause shutdowns in plastics plants. When this is the case, the loss of production is staggering, not to mention the cost of replacing or regrinding damaged roll! A well-known processor says, "Over the years RCA Metal Detectors have saved us tens of thousands of dollars in detecting foreign matter in our raw products which could damage our calenders. We feel the Detectors are cheap at any price."

Used on strip material traveling at speeds from 15 to 1000 ft. per min., with full inspection sensitivity, the Detector can be arranged to sound an alarm, and/or stop the traveling material. In plant after plant, the RCA Electronic Metal Detector has paid for itself many times over through increased life of costly machinery, decreased downtime, and savings in product. It can be put to work quickly in *your* plant.

Find out today how the RCA Metal Detector can save you money. Write for latest literature, RCA, Dept. M-75, Building 15-1, Camden, N.J.

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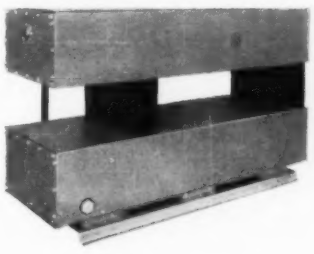


RCA ELECTRONIC METAL DETECTOR

Acrylic worm feed is turned on milling lathe from huge single rod. The finished worm feed, which may well be the largest machine part ever made entirely of plastic, is used to move corrosive and easily contaminated slurries in chemical plants

Giant acrylic worm feed for chemical blending

A large worm feed, 15 in. in diameter and 50 in. long, for use in a chemical production unit, has recently been fabricated entirely of acrylic.

For the proposed application—a blender-feeder which would mix and transport viscous slurries—it was imperative that any possibility of metal or metal-alloy contamination be eliminated. Because acrylic met all the chemical specifications, could easily withstand the mechanical operation itself, and could be machined to the close tolerances required, it was chosen for the job.

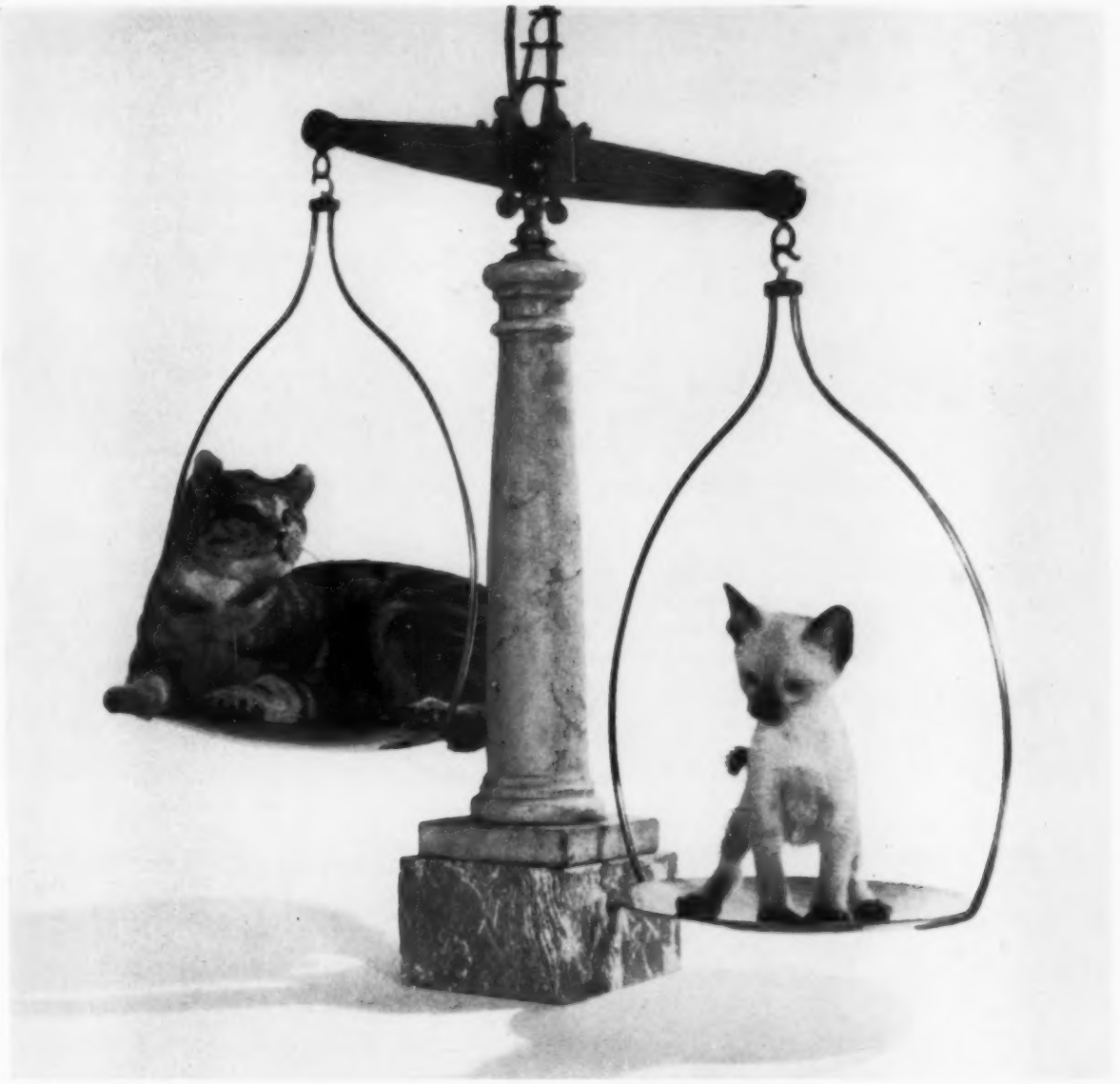
The worm feeder was made by the Specialty Equipment Div. of Chemineer, Inc., Dayton, Ohio, with assistance from engineers of Rohm & Haas, which supplied the acrylic.

Since the plastic does not come in stock thicknesses sufficient for a part of the dimensions required the problem was solved by bonding 3-in. thick pieces together until the desired length was reached. First, 3-in. sheets were cut into disks a little larger than the required diameter, with the flat surfaces of each disk machine faced to insure parallel surfaces. These disks were then cemented with PS-18, a Rohm & Haas solvent type cement. The resultant solid rod of acrylic was then bored and keyed through its entire length to permit the insertion of a metal shafting. After the shaft was installed, the unit was turned on a milling machine by special gearing attached to the horizontal table.

When the final assembly was made, the precision machined giant acrylic worm cleared its casing by 0.010 inch.

Engineers at Chemineer believe the acrylic blender-feeder may open the way for a new approach to the mixing, blending, and feeding of corrosive, viscous, or easily contaminated liquids or slurries.—END

ARGUS
announces
MARK LL



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NEW MARK LL powerful vinyl stabilizer – latest addition to the Argus line – gives you more and better stabilization at *less* cost. Easily dispersible liquid Mark LL stabilizer will give you:

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MORE light stability;
BETTER maintenance of the true tones of sensitive organic pigments.

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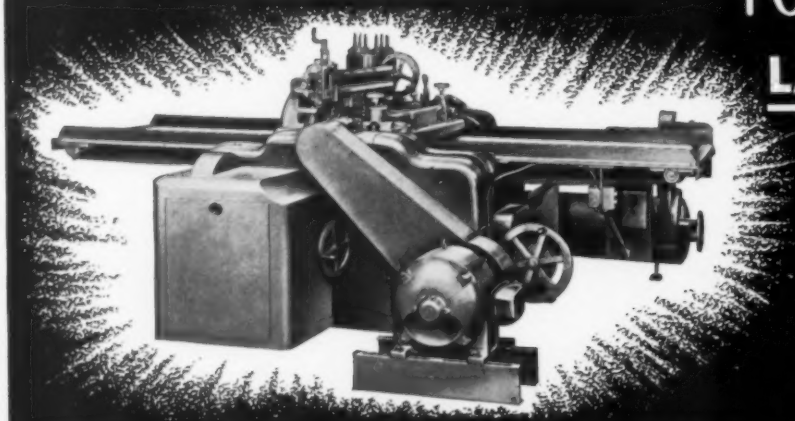

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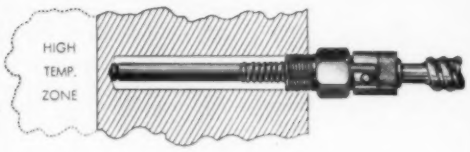

You always get fast, dependable response from T-E's miniature bayonet thermocouples because (1) spring-loaded hot junctions are always held in tight contact with the measured surface—regardless of expansion and contraction, and (2) the 'couples themselves are extremely sensitive to temperature changes. Available in C-C, I-C and C-A, they are widely used with cylinder heads, extruders, heat transfer lines and other similar applications. Different length adapters permit use of one T/C to measure temperatures at various depths. Pipe-clamp adapters are also available. Bayonet-lock caps provide quick, easy removal. Lead connections are supplied straight or with 45° or 90° angles. All probes and adapters are of stainless steel.

Write for Bulletin 2-P.

Thermo Electric Co., Inc.
SADDLE BROOK, NEW JERSEY
In Canada—THERMO ELECTRIC (Canada) Ltd., Brampton, Ont.

Relative Ratings of Low-Temperature Vinyl Plasticizers

(10 = best, 0 = poorest)

	Dioctyl Iso-sebacates	Diiso-octyl Iso-sebacate	Octyl Seba-cates	Octyl Aze-lates	Octyl Adi-pates	Diiso-decyl Adi-pate	Dioctyl Phthalate (blending material)
Compatibility (roll spew)	6	5	6	7	9	5	10
Strength: tensile, modulus, elongation	7	6	7.5	7.5	8	7.5	9
Low Temp.: stiffness, brittle point	7.5	7.5	8.5	8.5	8.5	7.5	3.5
Stability: heat and light	8	8	7	8.5	7	6.5	8
Extraction: water, soap soln.	8.5	8.5	9.5	7.5	4.5	6	8
Extraction: oil (vegetable, mineral)	3.0	4	2	1	1	3	7
Volatility (carbon)	7	7	8	6.5	2.5	7	7
Relative Rating	47	46	48.5	46.5	40.5	42.5	52.5
Approximate Price Index* (Isosebacates = 100)	100	100	135	105	90	90	65

* Based on current (Aug. 1958) prevailing prices for finished plasticizers.

Esters of **ISOSEBACIC®** Acid
Compare Favorably with Other Vinyl Plasticizers

Octyl esters of the new U.S.I. ISOSEBACIC Acid have been evaluated against accepted vinyl plasticizers in a complete series of tests at the U.S.I. laboratories. The performance results, expressed as relative ratings above, have been coupled with current price indexes to show comparisons which are meaningful to the maker of vinyl plasticizers. Here are the conclusions:

The octyl isosebacates are less expensive than sebacates and closely competitive in overall performance. They have an edge over azelates on cost and are about equal in performance. While comparing closely on cost with the adipates, they are better on overall performance. On specific properties, such as heat stability and resistance to extraction by vegetable and mineral oils, the octyl isosebacates are superior to other low-temperature vinyl plasticizers.

ISOSEBACIC Acid is a new synthetic intermediate made by U.S.I. — a mixture of the three C-10 dibasic acids: 2-ethyl suberic, 2,5-diethyl adipic and sebacic acids. It is not subject to the price fluctuations unavoidable with raw materials derived from natural products.

This valuable new intermediate will be available soon in commercial quantities from a new U.S.I. plant at Tuscola, Ill. Now is a good time to evaluate ISOSEBACIC Acid as a raw material for your operation. Send for pilot plant samples and technical data bulletins.

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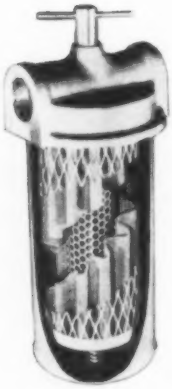

LINE TYPE
(Cutaway)

SUMP TYPE
(Cutaway)

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Reduce Maintenance —

PRODUCTION ENGINEERS and MAINTENANCE MEN, whose job it is to keep machinery operating at peak efficiency, are specifying Marvel Synclinal Filters on new equipment and standardizing with Marvel's on existing equipment.

OVER 800 Original Equipment Manufacturers install MARVEL SYNCLINAL FILTERS as standard equipment for dependable protection on all hydraulic and other low pressure circulating systems.

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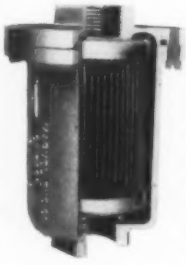

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- ☐ Catalog #301—For Water

MP-11

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Vinyl protective glove

To protect guided missile fuel handlers, and others needing protective handwear, the Quartermaster Research & Engineering Center, Natick, Mass., has designed a supported vinyl glove that fits the hand in its relaxed, ready-to-work position.

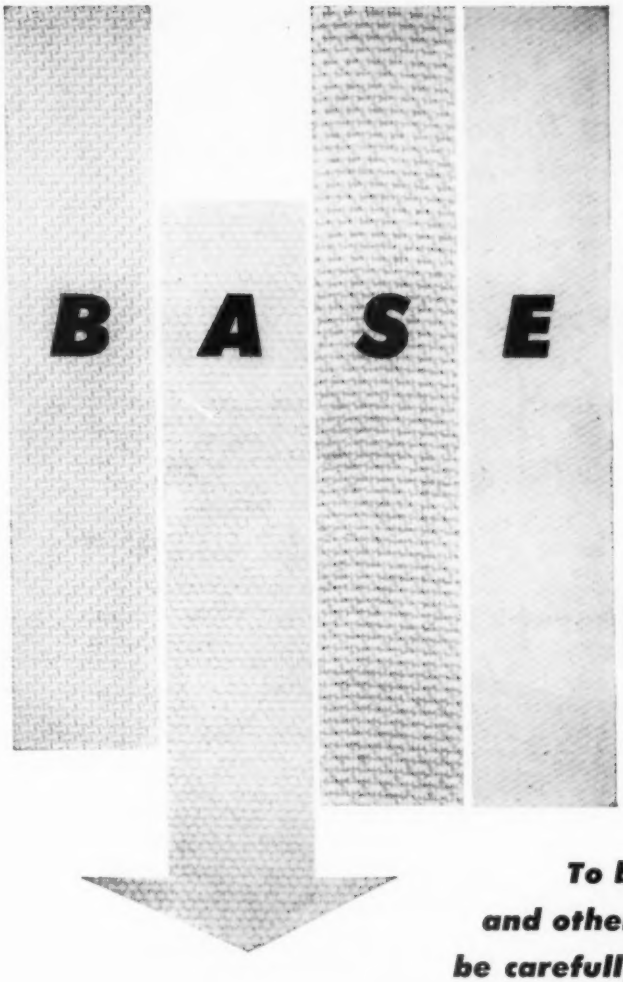
Fabricated under a Quartermaster Corps R&D contract, the supporting fabric is made from two cut pieces of base fabric, which are sewn together in the form of a 5-finger glove. After the fabric glove has been turned so that the sewn seam is on the inside, it is mounted on a form and dipped in a vinyl resin dipping compound. The resin is then fused by heat, and the completed glove is removed from the form for trimming, marking, and pairing.

Fingers of the glove are formed in a normal working pose, which affords a greater degree of efficiency and manual dexterity than do straight-fingered gloves. Agility is further enhanced by foreshortening the fingers to allow a better fit.

Conventional gloves of this type have the hand in a flat position with the fingers extended. The user not only finds them more cumbersome, but also uncomfortable during the breaking-in period.

Of the 300 soldiers tested, 99.3% found that they could be comfortably fitted with three of the four available sizes.—END

Supported vinyl glove (left) was designed for the relaxed, ready-to-work hand. At right is sculptured dipping form



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Sequential molding

(*From pp.* 187-192)

put of about 60 w./sq. in. is more than ample to bring the melt surrounding the spreader to the desired temperature.

The melt adjacent to the outside surface of the annulus tends to chill to a viscous skin that insulates the adjacent mold cavity from the internal heat (the nozzle has no external heating element).

Maintenance and safety

Because SIM depends on the sudden release of high melt pressures and creates off-center clamping loads, we originally had serious doubts as to how well the equipment—new or converted—would hold up. After four years of operation with the system, we now know that these doubts were unfounded. Not only have heating cylinders and molds held up excellently, but the flow-control valves have also performed for long periods of continuous operation. If dimensions are met and hardness preserved in making the valve components, as much as a year's service can be expected. However, if tramp metal should get into the plastic, the valve seat may be damaged.

Because the plastic in the cylinder is under high pressure during much of the total cycle, questions have been raised concerning safety, particularly when the operator is reaching into the machine to eject or remove parts. Actually there is no danger, since the pressure in the entire system is relieved to zero as the plunger returns just before the mold opens. The operator must close the door, as usual, before the valves close and the plunger starts forward.

Even if the molds are designed to operate automatically, the pressure in the melt system must still be relieved. If the machine has two oil systems, one for injection and one for clamping, the circuit may be controlled so as to automatically return the plunger and open the flow control valves if the door is opened. Under automatic operation, this would allow the pressure in the injection end to be built up while

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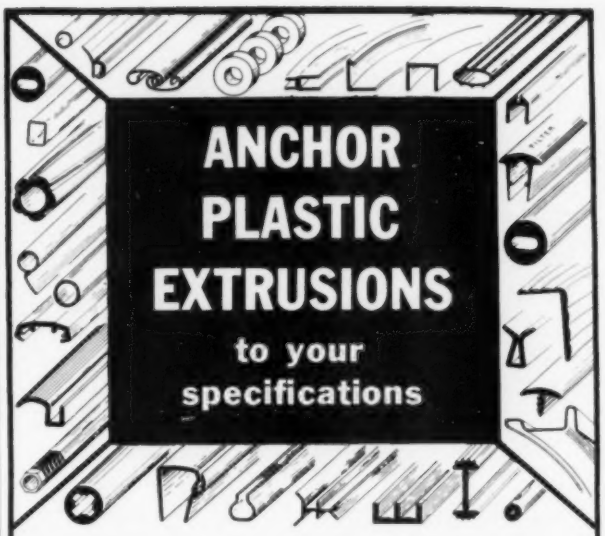

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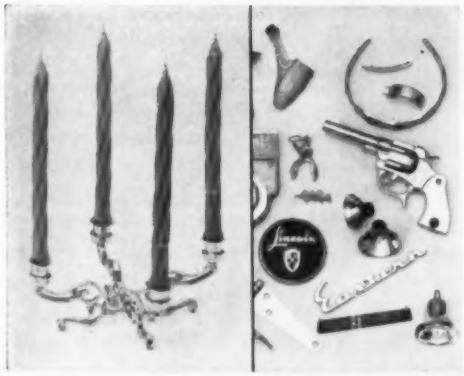

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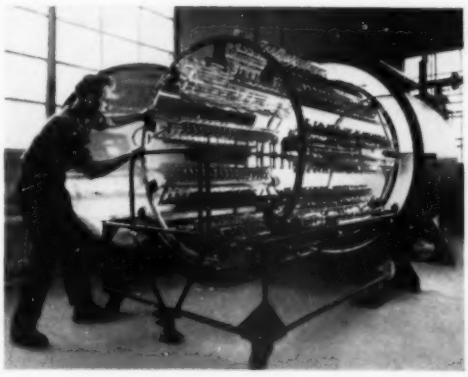

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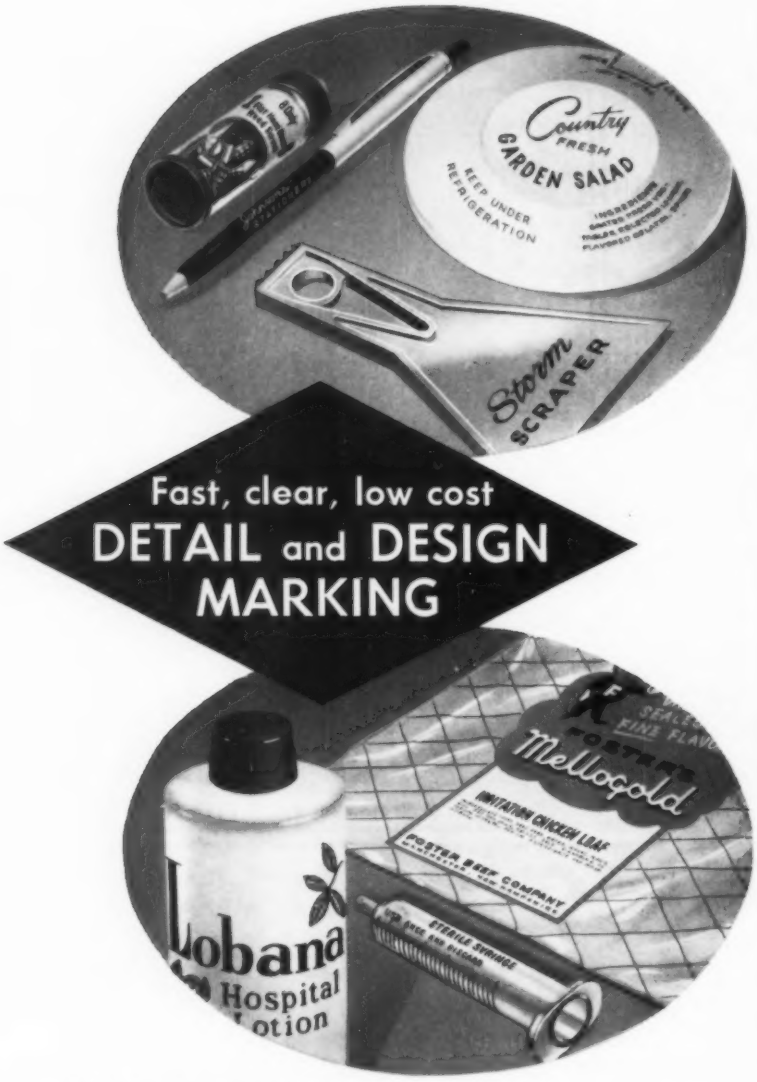

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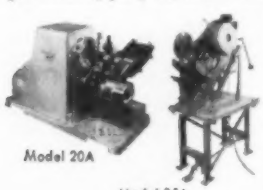

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the molds are opening and closing, yet provide a safety factor in case the door was accidentally opened.

Special equipment needed

Machinery for SIM[1] must have: 1) an additional electrical panel with timers and nozzle voltage regulators; 2) an additional hydraulic panel with a small accumulator and several three-way valves, depending on the number of cavities (or groups) to be molded in sequence; 3) a pressure manifold mounted in front of the heating cylinder into which the flow-control valves are mounted. It is also desirable to have internally heated nozzles. Where only one flow-control valve is used, it is mounted between the heating cylinder and the nozzle and no manifold is needed.

If mounted singly in the platens, any two conventional single-cavity molds of the same thickness can be molded sequentially. Investigation will show that most tooling, with some modifications, can be adapted for SIM, and *all* conventional tooling can be advantageously operated with only a single flow-control valve.

Conclusion

To date, SIM has been used chiefly for the difficult job of automatically molding thin-section pieces. But it provides basic advantages valuable to all types of molding situations: 1) it greatly amplifies the power and accuracy of any machine's injection system; 2) it simplifies set-up and control of injection molding operations; 3) it magnifies clamping capacity; and 4) it versatilizes tooling. All these advantages contribute to increasing outputs and cutting molding costs, though their relative contribution will be determined to some extent by the nature of the product being molded. Directly and indirectly, these basic advantages not only improve the quality but also the uniformity of the product.—END

[1] Equipment for SIM will be made and sold exclusively by Fellows Gear Shaper Co. under license from Bopp-Decker. Such equipment will include new machines completely fitted and standard conversion kits which can be adapted to any make machine in the field. Purchase of equipment or kits gives buyer full rights to use SIM process.

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NEWARK DIE AUTOMATIC UNSCREWING MOLDS

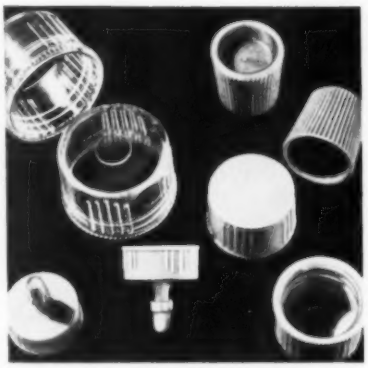
solve screw cap production problems

Typical automatic unscrewing mold shown parted. It is used for making Lysol caps and is one of many such molds designed and manufactured for Armstrong Cork Company.

Today's trend in packaging is placing increasing emphasis on complex cap design and the bold use of color. To meet these needs Newark Die has developed an advanced type of automatic unscrewing mold which permits the economical production of a wide variety of cap designs.

This development cuts mold costs by utilizing standard unscrewing mold bases which also permit rapid and economical replacement of cavities to accommodate new designs.

Look to Newark Die for practical solutions to your cap production problems.



Newark Die molds are used to make a wide variety of screw caps of which these are typical.

VISIT BOOTH 471
Eighth National Plastics Exposition

ND

NEWARK DIE COMPANY
22 SCOTT STREET, NEWARK, NEW JERSEY
PHONE: MArket 2-3305

γ–irradiated plastics

(From pp. 199-221)

(molecules of functional group per 100 e.v. absorbed by sample) is given by:

$$G = \frac{\text{weight fraction} \times N \times 100}{M \times D}$$

where N is Avagadro's number, M is the molecular weight of functional group in g./mole, and D is the radiation dose in e.v./g. (it is assumed that the roentgen equivalent is 83.3 ergs/g.). By combining these equations and rearranging we have:

$$\frac{(P)\ (K_{0.1})\ (10)\ (M)}{(N)\ (100)}\ G = \frac{\log\ (T_0/T)}{LD}$$

Multiplying by a constant k to change D to Mr (megaroentgens; 5.24×10^{13} e.v./g. equals one roentgen; see also assumption for D above) we have:

$$\frac{k}{10N}\ (P)\ (K_{0.1})\ (M)\ G = \frac{\log\ (T_0/T)}{L\ Mr}$$

For a given material and functional group measured, (P), ($K_{0.1}$) and (M) are constant. k/10N is a constant (see above), therefore let

$$K = \frac{k}{10N}\ (P)\ (K_{0.1})\ (M)$$

and finally:

$$Q = KG = \frac{\log\ (T_0/T)}{(L)\ (Mr)} \qquad \text{Eq. 6}$$

Derivation relating carbonyl absorption with sample thickness: An interesting property of Q as defined previously can be shown. The reciprocal of Eq. 6 is:

$$\frac{1}{Q} = \frac{LMr}{A}$$

where A equals log (T_0/T). Figure 17, p. 221, shows a plot of $1/Q$ versus L which is seen to give a straight line. Thus,

$$\frac{1}{Q} = mL + b$$

$$\frac{LMr}{A} = mL + b$$

$$A = \frac{LMr}{mL + b}$$

where m and b are constants. Taking Mr as constant and defin-

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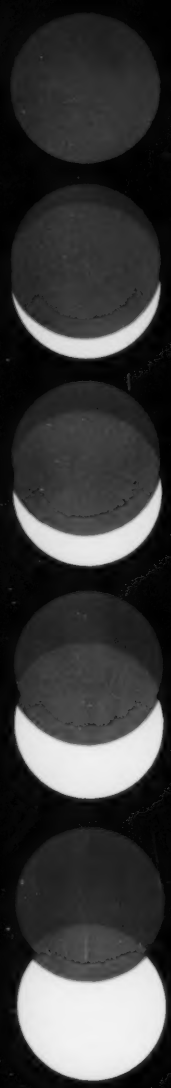

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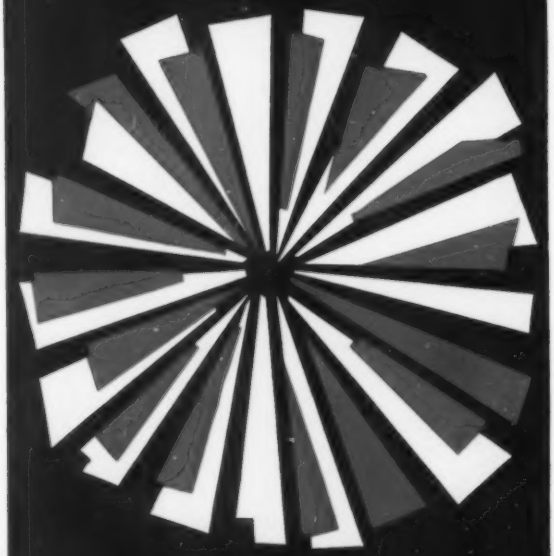

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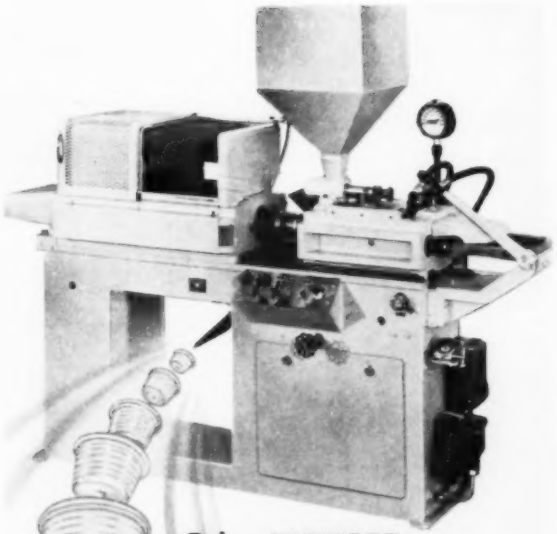

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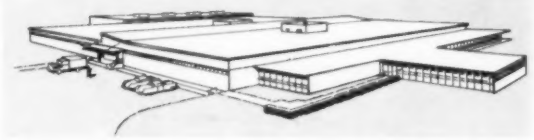

ing B equal to b/Mr, and C equal to m/Mr, we have the following expression

$$A = \frac{L}{BL + C}$$

and rearranging:

$$\frac{L}{A} = BL + C \qquad \text{Eq. 7}$$

Acknowledgment is made to the following individuals of the Hanford Atomic Products Operation, General Electric Co., Richland, Washington: S. W. Smith and F. M. Newby for their assistance in carrying out the irradiations, H. J. Anderson for the mass spectrometer analyses, and R. E. Nightingale for helpful discussions concerning the interpretation of the infra-red results that were obtained here.

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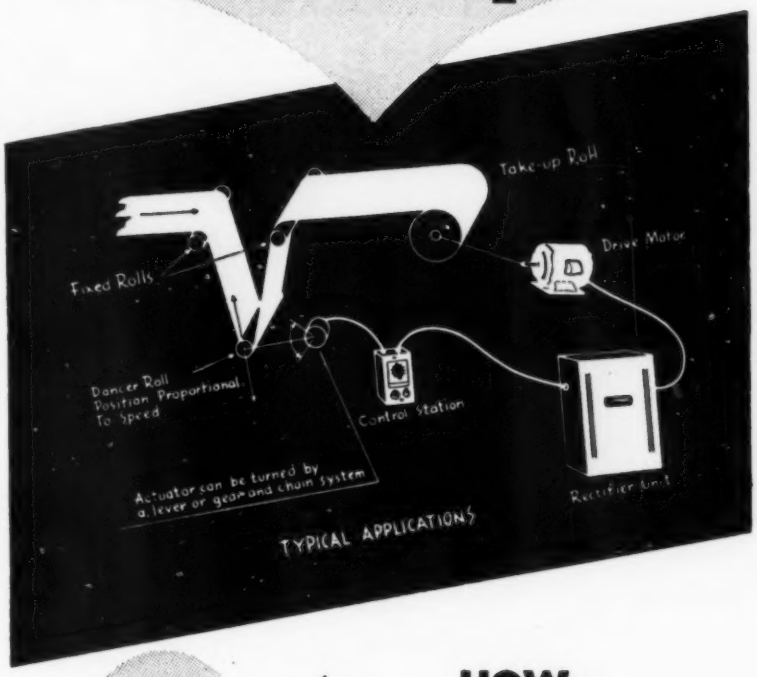

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Powhatan Mining Co. is the exclusive producer of Powminco asbestos fiber, used as a filler and an absorbent and extender in phenolic and polyester resins. It is the only completely fiberized acid resistant asbestos fiber in the United States.

Powminco Asbestos is practically inert. It is not affected by as much as four hours boiling in concentrated hydrochloric acid. This gives it a distinct advantage over ordinary chrysolite fiber when used in molding compounds that require an acid catalyst (phenolics, for example), and in casting resins.

Powminco Asbestos, an anhydrous magnesium silicate, has very little water in its composition. This results in unusually low shrinkage when it is included in plastic compounds used in molding and tooling operations. Other desirable characteristics of Powminco Asbestos are its extremely low magnetic iron, and its very high dielectric strength.

The Powhatan Mining Co. controls the production of Powminco Asbestos from mine to finished fiber, and every processing operation is performed under strict quality controls.

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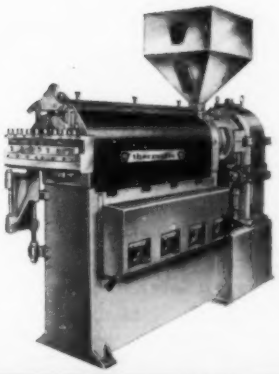
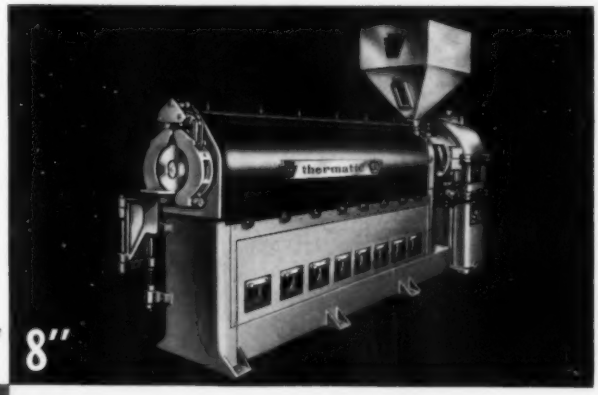


4½"



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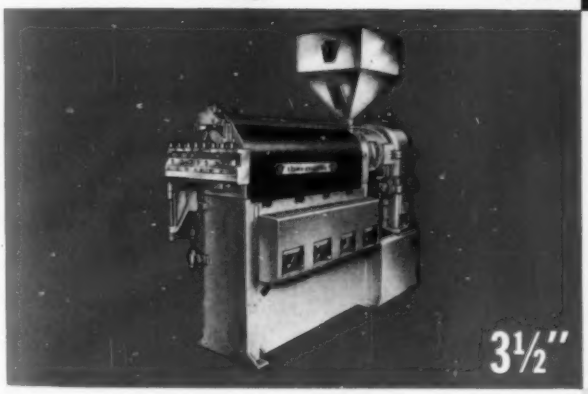

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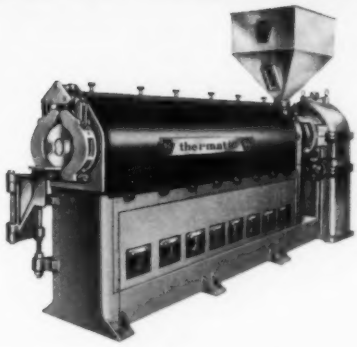

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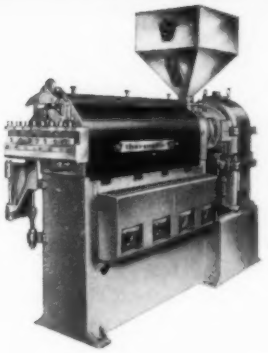

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More Horsepower Capacity	64	107	142	209	308
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Greater Output (lbs./hr.)*	200	375	600	900	1500

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The Plastiscope

News and interpretations of the news
By R. L. Van Boskirk

Section 2 (*Section 1 starts on p. 39*)

Fosta Nylon speeds molding cycles

Commercial production of Fosta Nylon 62 A S K at its Manchester, N. H., plant has been announced by Foster Grant Co., Inc. This is the first of the special Bayer-type nylon molding materials produced under its license agreement with Farbenfabriken Bayer and is made in addition to F. G.'s regular nylon formulations.

VP Sidney Baum states that 62 A S K is faster setting and more rigid than other types of nylon-6 materials and that release problems are eliminated. He asserts that thin and thick sections in a single molded item have the same homogeneous structure and the same relative strength characteristics, and that molding cycles can frequently be reduced as much as 20 to 40 percent. Further claims are that the homogeneous structure eliminates internal strains and avoids problems of uneven shrinkage or swelling normally resulting from absorption of atmospheric moisture by materials of non-uniform crystalline structure. Finished parts are said to have high dimensional stability. Mold temperatures can be raised above 200°F. for even better stiffness, surface hardness and abrasion resistance.

Polyolefin wax

The price of wax polyolefin DYDT, manufactured by Bakelite Co., Div. of Union Carbide Corp., has been reduced from 39 to 35¢/lb. This material is used to upgrade paraffin and microcrystalline waxes for coating of paper and paperboard.

The coated packaging materials are used primarily for milk cartons, bread wraps, and frozen food wrappers, where the use of wax polyolefin DYDT is said to afford higher gloss, and less blocking while permitting faster sealing.

*Reg. U.S. Pat. Off.

Stippled vinyl wall covering

Wall covering that looks like stippled paint and has all the advantages of vinyl has been introduced by L. E. Carpenter & Company, Inc. It is called Vicrtex VEF STIP-L-TEX. It has a flat matte finish and is said to be washable, fadeproof, crackproof, and peelproof. It may be hung on wood, metal, glass or plaster.

The new material is suggested for offices, corridors, dividing partitions, and similar surfaces.

Carpenter states that it will match any color (they stock 40) on orders of 300 yards or more.

Polyethylene mesh

Surgical mesh made of high-density polyethylene has been used successfully in the repair of tissue defects of the chest and abdominal wall, according to Dr. Francis C. Usher, Associate Professor of Clinical Surgery at Baylor University College of Medicine, Houston, Texas. The mesh was developed by Phillips Chemical Co., Bartlesville, Okla.

Reporting on results of an 18-month search for an inert plastic prosthesis that would set up very little foreign-body reaction, Dr. Usher stated that among the materials investigated (Teflon, Marlex, Orlon, Dacron, and Nylon) Marlex was found to be well tolerated in tissues and thus may represent a valuable plastic for certain surgical procedures. Teflon was also found to be promising.

Nylon hardware uses

Recent studies by Du Pont show that nylon and other engineering plastics, such as Delrin acetal resin, have tapped only about 16% of possible applications as hardware. This estimate is based on the ability of these resins to do the job of metal, and offer economic incentives to change over to a new material.

A major factor in favor of the plastics materials is that fabrication is usually a one-step operation, and finishing operations are not needed. The declining price of nylon is another factor. At the present level nylon frequently permits up to one-third reduction in cost over the same part in metal, Du Pont claims.

Hardware applications which have proved successful, include a refrigerator door latch which was found to outlast steel, and another instance where nylon replaced pressed powdered metal to give lock parts with more uniform dimensions. The plastics materials also provide corrosion resistance, which is useful in outdoor locks. On another lock, a cylinder plug of nylon eliminated electrolytic action, the need for lubrication, and malfunction due to sticking parts. No wear was reported after a million cycles.

Another application is in aluminum awning windows, where one manufacturer used 57 parts of nylon in the working mechanism, and produced a window that presented no friction problems even in the harsh salt air and sun conditions of Florida.

Du Pont reports that 13 different nylon marine hardware products are now on the market, ranging from air horns to cleats and oarlocks. The resilience of the plastics material to underwater impact is used to advantage in a powerboat speedometer, where a 4-in. nylon part protrudes below the bottom of the boat to sense the change in water pressure. This same property may make nylon an ideal material for propellers, as the blades would tend to spring back when struck

News about R&A SINCE 1913 **Adhesives**

FOR ALL METALS AND ALL PLASTICS

New "room temp" curing epoxy adhesive spreads like cold cream

TECHNICAL DATA ON

Bond*master*® M688

A thixotropic, room temperature curing, 100% reactive, two-component, solvent-free modified epoxy adhesive designed for bonding metals and rigid plastics as well as other rigid materials to themselves and to each other.

APPLICATION

Mixed BONDMASTER M688 is soft and buttery, making it extremely easy to spread smoothly and evenly. Once applied, it maintains its form and DOES NOT FLOW during the curing cycle. Excellent for "poor fit" and similar void-filling applications as well as where dripping or running of adhesive cannot be tolerated.

CURE

Bonded assemblies which have been cured at room temperature can be handled in 4 to 6 hours and develop 85% of their maximum strength in 14 to 24 hours. Alternately, where practical, any of the following heat-cure cycles may be used to achieve full strength more rapidly: 100°F for 2 hours; or 150°F for 30 minutes; or 200°F for 15 minutes; or 250°F for 10 minutes. See Technical Data Sheet for alternate hardeners, pot life, cure cycles, etc.

BOND CHARACTERISTICS

Fully cured bonds exhibit minimal shrinkage, are electrical insulators, and provide excellent resistance to weather, galvanic action, and most chemicals, acids, and alkalies.

R&A SINCE 1913

RUBBER & ASBESTOS CORPORATION

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Here is why you can save valuable application time as well as material costs with this 100%-reactive, solvent-free epoxy adhesive, BONDMASTER M688:

- Smoothly, easily spreadable with trowel, spatula, knife edge, etc.
- Non-sag (thixotropic) in any position . . . even while curing. Eliminates costly cleanup.
- Cures at room temperature in about 24 hours . . . or in as little as 10 minutes if you can heat to 250°F.
- 100%-reactive . . . no waiting for solvent evaporation . . . mere contact pressure is sufficient.
- Solvent-free . . . no danger of attack on soluble thermoplastics (cells of foamed polystyrene, for example).

ALL METALS—ALMOST ALL PLASTICS

You'll get strong (in excess of 2,000 psi tensile shear on aluminum-to-aluminum, for example) bonds with cast iron, steel, stainless, magnesium, aluminum, copper, brass, bronze . . . *any* metal . . . to themselves or to just about *any* plastic—rigid, foamed, or flexible.

And, of course, to glass, ceramics, wood, and structural laminates based on reinforced melamine, polyester, phenolic, epoxy, etc., resins.

WRITE FOR FURTHER DATA

Write for detailed Technical Data Sheet today. We'll be glad to send a free sample as well if you will describe your bonding problem in detail.

The Plastiscope

by logs and other underwater obstructions.

Nylon has made scarcely any impression in applications as garden tools and equipment, a field which Du Pont ranks high in opportunity.

Low-cost polyether

A new polyether derived from low-cost sorbitol, and designed for rigid urethane foams, has been developed by Atlas Powder Co., Wilmington, Del. It has six hydroxyl groups available for cross-linking.

Since rigid urethane foams can use up to 60% by weight of this new polyether, the company states, manufacturing costs can be reduced up to 25%, and the market for rigid foams, therefore, could be significantly increased.

The price range of Atlas' polyether will be about the same as that of polyethers for flexible foams, and less than the polyesters which are now being used to manufacture rigid urethane foam.

Blow molding machines and licenses offered

German machines, said to be fully protected by U. S. patents and U. S. patent applications, are now available in the United States for blow molding bottles, containers, toys and other hollow objects.

The machines are manufactured by Kautex-Werk Reinold Hagen, Hangelar (Bonn), Western Germany, and are distributed in this country by Kautex U. S. Sales Co., Inc., 38-01 23rd Ave., Long Island City 5, N. Y. In addition to being sales agent, Kautex U. S. is the trustee of the patent structure relating to the machine, including that of Owens-Illinois, which is being used by the German manufacturer. Under this arrangement, Kautex U. S. will sell the machines and will license users for the blow molding process on a royalty basis—on a descending scale according to volume of production—and Kautex states that it will hold each user free and harmless in case of patent infringement litigation.

According to the sales agent, the Kautex machine is very versatile, and differs from other blow molding machines because it uses the rising platen concept. Molds can be changed in about one hour, and single cavity molding is said to be possible with this machine, which can blow mold most thermoplastic resins.

Although the machine is said to be easy to operate, Kautex U. S. is prepared to train the engineering staff of its customers, and also hold 5-day "shirt sleeve seminars" if desired.

A relatively untapped market for blow molded objects is thought to exist in the toy industry, and it is claimed that the Kautex machine can produce a doll body from polyethylene at half the cost and one quarter the weight of rotationally molded vinyl. It is also said to be possible to produce 1000 ten-gram (roughly $\frac{1}{3}$ oz.) parts per hour on this machine. Large hollow bodies for containers or industrial parts can also be manufactured by this process and, for example, Kautex has equipment that will blow mold an object 34 in. high and 14 in. in diameter in a 6-min. cycle.

At the moment, delivery of the Kautex machines is about eight weeks after receipt of order.

Vinyl on metal

Additional background on the use of vinyl-metal laminates in the transportation field (see "Vinyl-metal laminates—up 1800% in two years, M. PL. April 1958, p. 102) have been supplied by American Car & Foundry, Div. of ACF Industries, Inc., New York, N. Y. That company reports that it used the Marvibond process in producing vinyl-metal laminates for the entire inside finish of the Southern Pacific Gallery cars built at St. Charles in 1957. Before that, the company used an O'Sullivan Rubber Co. vinyl-metal laminate for head lining in the Missouri Pacific President's Business Car built in 1956 and prior to that—as far back as 1949—American Car & Foundry used cold bonded vinyls on metal quite extensively.

Fast-curing catalyst for urethane foam

A new catalyst for urethane polymers, N, N, N', N'-Tetramethyl-1,3-butanediamine is now available from Union Carbide Chemicals Co., Div. of Union Carbide Corp. The chemical is a colorless, stable liquid that is said to be completely soluble in water and common organic solvents.

According to the company, the new amine is more reactive than the urethane catalyst systems commonly used, permitting faster curing of urethane foams. Tetramethyl butanediamine is also said to have an exceptionally low odor level, and to yield soft, pliable foams.

The new chemical may also be a valuable catalyst for curing epoxy resins, the company states.

Protectants for polyethylene

Several important findings on the subject of aging and deterioration of polyethylene have been reported by the Polymer Research Dept. of Bell Laboratories. The findings, while also of major theoretical significance, have practical implications for the plastics industry. The findings are published in *Bell Laboratories Record*.

1) The Bell investigators report the discovery of a new class of sulfur-containing thermal antioxidants which are effective in the presence of carbon black. The exact role of these sulfur compounds is not clear. They may not in themselves be antioxidants; the real protective action may reside on the surface of the carbon black particles dispersed throughout the polyethylene, whose antioxidant activity may be only reinforced, or renewed, by reaction with the sulfur compounds.

2) Accelerated aging tests were found to have a high degree of reliability. In fact, if anything,

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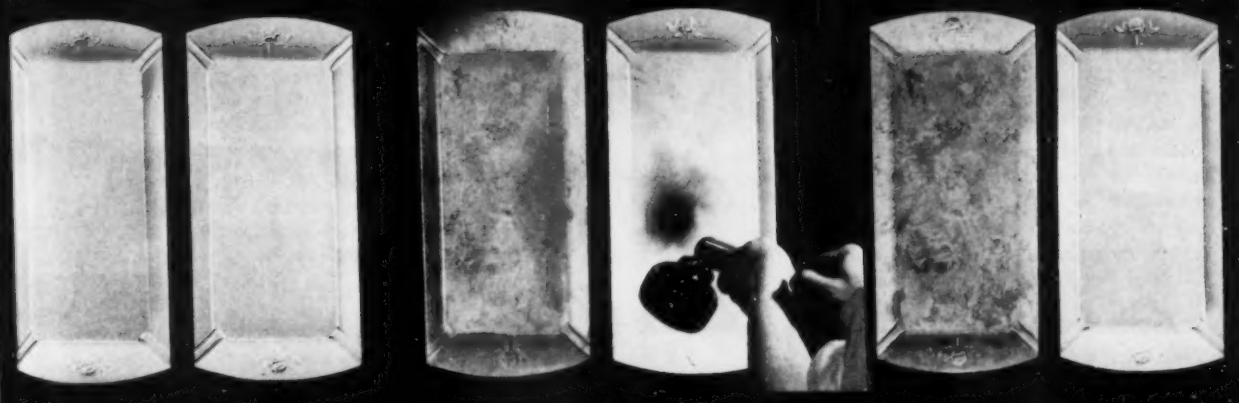
static dissipating styrene molding powder

LUSTREX LO-STAT

Translate this test into new production economies and sales advantages:



1. Two trays from same mold. Left: molded of standard material. Right: molded of Lustrex Lo-Stat.

2. Charcoal dust is sprayed on both trays.

3. Result! Dust pattern on standard tray corresponds to static electric charge. Tray of Lustrex Lo-Stat is practically clean. The little charcoal remaining is easily tapped off.

Think what Lustrex Lo-Stat can mean in keeping housewares clean and appealing, how much longer signs, displays and packages will stay attractive. Air conditioner and fan grills are other moldings that will be improved. There are dozens of jobs that Lustrex Lo-Stat dust-resistant styrene can do better. And production economies include the elimination of spraying and bathing; open storage and simplified handling. Lustrex Lo-Stat is in full production. Send for a trial quantity now along with complete technical data. Monsanto Chemical Company, Plastics Division, Room 223, Springfield 2, Mass.

Monsanto

The Plastiscope

these tests may have underestimated the effectiveness of carbon black. Some carbons now appear to be effective antioxidants at temperatures approaching those encountered in service.

3) Bell scientists point out that the results oppose a basic tenet of anti-oxidant theory—that the protectant to be effective must be free to move to the site of incipient oxidation. This cornerstone of present anti-oxidant theory must be re-examined, however, if, as it now seems, carbon particles in fixed positions hundreds of angstroms apart are able to check oxidation in its early stages.

The consequences of a revised theory may have practical as well as fundamental importance, Bell scientists believe. There are already indications that special carbon additives—combination light screens and antioxidants—may eventually prove to be the ideal outdoor protectants for polyethylene.

Problems of photo and thermal oxidation of polyethylene are of vital interest to the company, since the Bell System uses large amounts of polyethylene for sheathing and insulating thousands of miles of cable, and billions of feet of cable conductor.

Planned foam properties

Research data provided by Mobay Chemical Co., Pittsburgh, Pa., indicates that it is now possible to plan the properties of urethane foams while they are still in the liquid chemical stage. This development amounts to a blueprint for the manufacturer of foams.

Previously, a desired formulation could be attained only after considerable experimentation and after careful testing of finished foam samples. The new method of measuring the distance between cross-links in the molecular chain which makes up the polymers, not only provides a means of preplanning the properties of foams, but is also an important aspect of quality control.

Briefly, Mobay discovered that polymers with longer distances between each cross link will produce foam that is softer and more elastic, and that the reverse will result in stiffer foams. Since the chemical composition which results in these physical properties can now be calculated, a manufacturer can more easily reproduce a desired type of foam, or can formulate a foam that possesses the physical properties required for a specific application —such as softer foams for cushioning and mattresses, or firmer foams for automotive crash pads, packaging, etc.

SPE tackles housing program

The use of plastics in building and construction is the subject of the Retec program of the SPE at the Ambassador Hotel in Los Angeles, Calif., on Nov. 13, 1958. Among the subjects to be covered are use of new materials such as epoxy sealants and polystyrene foam in construction; building codes; plastics pipe; use of plastics panels including lighting fixtures and synthetic fabrics in building interiors. John Delmonte, Furane Plastics, Inc., 4516 Brazil St., Los Angeles 39, is general chairman of the meeting committee.

Makes allyl chloride

The Dow Chemical Co. has added allyl chloride to the product line at its Texas Div., which earlier this year entered the allied allyl alcohol field.

Allyl chloride is used as an intermediate in making epichlorohydrin which, when reacted with bisphenol, yields epoxy resins.

Spray mold release

A silicone spray mold release and lubricant, designated Paralese, has been developed by Para Products, 5200 River Rd., Washington 16, D. C. Formulated with a very high silicone-to-freon ratio, the spray is said to give a large amount of silicone per shot to provide full mold coverage.

The company has also formulated a companion product, Paralese zinc stearate dry powder spray, specifically designed for use on polyethylene and other molded parts which are later to be painted or plated.

NBC radio salutes plastics

The entire NBC radio network of nearly 200 stations will broadcast a feature program about the plastics industry on the eve of the 8th National Exposition of the S.P.I., Sunday, November 16, 1958 at 6:05 P.M. (New York time).

The broadcast is one of a series of salutes to different fields of American endeavor and professional activity, called "America on the Go."

Stocks more laminated plastics

A build-up program that will double warehouse stocks of laminated plastics has been instituted at the Norristown, Pa., and La Verne, Calif., plants of Taylor Fibre Co. Overnight shipments of many sizes of laminates can now be made from stock at the two plants. Included in the program are most of the standard grades in sheet, rod, and tube form.

New marketing research firm

A chemical marketing research service has been organized by James M. Margolis at 10 E. 39th St., New York 16, N. Y. Initial effort has been directed toward chemical specialties, particularly the plastics and pharmaceutical fields.

Mr. Margolis was a research chemist at Dewey & Almy Chemical Co., Div. of W. R. Grace & Co., and more recently with Stauffer Chemical Co.

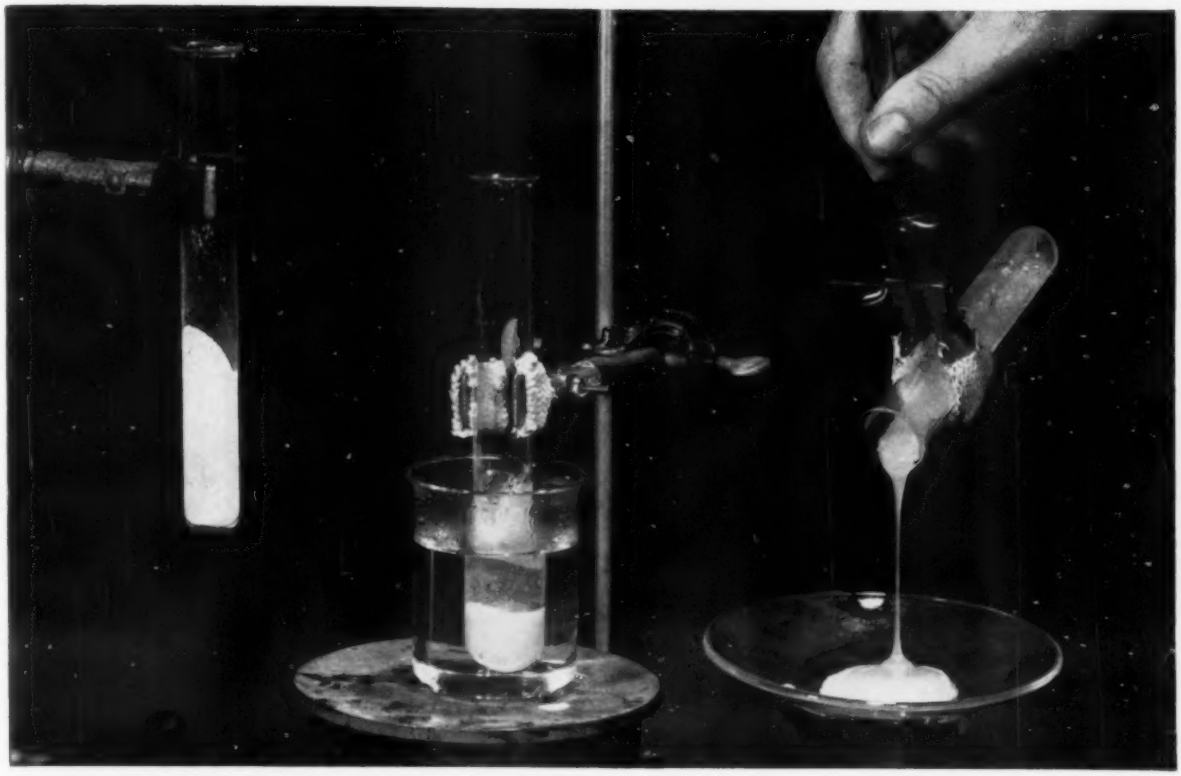
Patent survey

The world's polymerization technology patent literature will be surveyed by a new service announced by World Patents Monitor, P. O. Box 464, Rye, N. Y.

Subscribers will receive a monthly listing in English of titles, patentees or assignees, and number of patents currently issued on processes and products by nine countries. About 6000

For compounders with imagination . . .

12 VERSATILE MONSANTO SOLID PLASTICIZERS



Unique physical advantage:

1. Solid at room temperature **2. Liquid solvating-plasticizer at processing temperatures** **3. Solid again for outstanding end-use properties**

Monsanto solid plasticizers can do so many jobs so well for you—can be one of your most valuable compounding aids. In compatible systems, Monsanto solid plasticizers can impart many of the product benefits you want: sharp melting point, easier processing or melt viscosity, heat sealability, low volatility and migration, higher tensile and tear strength, excellent adhesion, lower cost.

At common processing temperatures, they melt and function as solvent-plasticizers . . . make possible higher solids content in adhesives, lacquers, paper and textile coatings—improve flow, leveling, "hot-tackiness" and nonblocking characteristics—aid in wetting fillers, speed fusion of resin binders, boost adhesion of film formers—give easier calendering, extrusion, molding, laminating and postforming properties to rigid products.

Applications? Here are a few which benefit from Monsanto solid plasticizers: heat-sealing coatings; rigid vinyl extrusions, moldings and foams; "break-away" stunt glass; phenolic brake band linings, surface coatings and composition wallboard; melamine coating and laminating resins; urea molding compounds; fire-resistant cellulose acetate sheets; crystallizing lacquers and other specialty coatings; polyamide, vinyl and other hot melts; delayed-tack adhesives, bookbinding adhesives and others.

Check the Melting Points of Monsanto Solid Plasticizers

Triphenyl Phosphate	49° C.	Santowax R	60-145° C.
Dicyclohexyl Phthalate	64° C.	Aroclor 5460	100-105° C.
Santolite MHP	65° C.	Aroclor 1268	135-160° C.
Diphenyl Phthalate	69° C.	Montar 9	130-160° C.
Santicizer 1-H	87° C.	Montar 4	140-200° C.
Santicizer 9	105° C.	Montar 5	180-250° C.

Chances are, one of Monsanto's solid plasticizers is compatible with the resins you are using—can materially improve your processing or product properties *now*. Write today for more information in the *new brochure*, "How you can benefit from Monsanto solid plasticizers."

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
Dept. PL-14, St. Louis 24, Missouri

Aroclor, Montar, Santicizer, Santolite, Santowax: Monsanto T.M's, Reg. U. S. Pat. Off.

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For latest Celanese Plastics Information see ad on page 9.

The Plastiscope

patents will be covered per year. Cost of the monthly service is $65 per annum.

Enters coating field

Plastic Coated Paper Corp. is the name of a new polyethylene coating firm which will have permanent quarters in a plant now being constructed at 210 Miller Rd., Hicksville, N. Y. The company plans to coat paper, board, foil, and other materials.

Until completion of the plant, scheduled for the end of 1958, Plastic Coated will maintain temporary headquarters at 550 Fifth Ave., New York 36, N. Y.

Stanley and Jerry Warshaw, former vice-presidents of Atlantic Gummed Paper Corp., Brooklyn, N. Y., are president and executive vice-president, respectively, of the new corporation. Ken Rawson, previously sales manager of Gilman Paper Co., New York, N. Y., has been named general sales manager.

PVA prices reduced

Prices of Vinol CWS (Exp. L-19), cold-water-soluble polyvinyl alcohol, manufactured by Colton Chemical Co., Div. of Air Reduction Co., Inc., have been reduced 15 to 25%, depending on the quantities ordered.

Good adhesive properties, clarity, and binding abilities, are said to characterize Vinol CWS, and films formed from it are permanently flexible, the company claims.

An application under development is the use of Vinol CWS cast film in the packaging of soaps, detergents, and similar products.

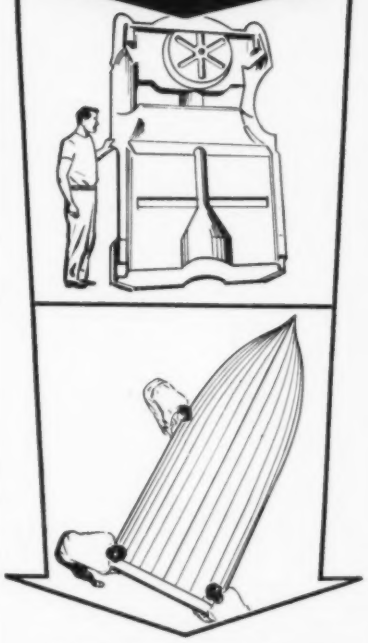
New raw material source

Scientists at the University of Mississippi are conducting research into the possibilities of utilizing Southern agricultural products as raw materials for the chemical industry.

Under a contract recently let by the U. S. Dept. of Agriculture, constituents of tung oil, sugar cane, and pine gum are being investigated for conversion into

Large parts, too, can be mass-produced of strong, lightweight

MOLDED FIBER GLASS



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Molded Fiber Glass Body Company can custom-mold your big products of strong, lightweight, rust-proof, impact-resistant MOLDED FIBER GLASS, using matched metal dies...

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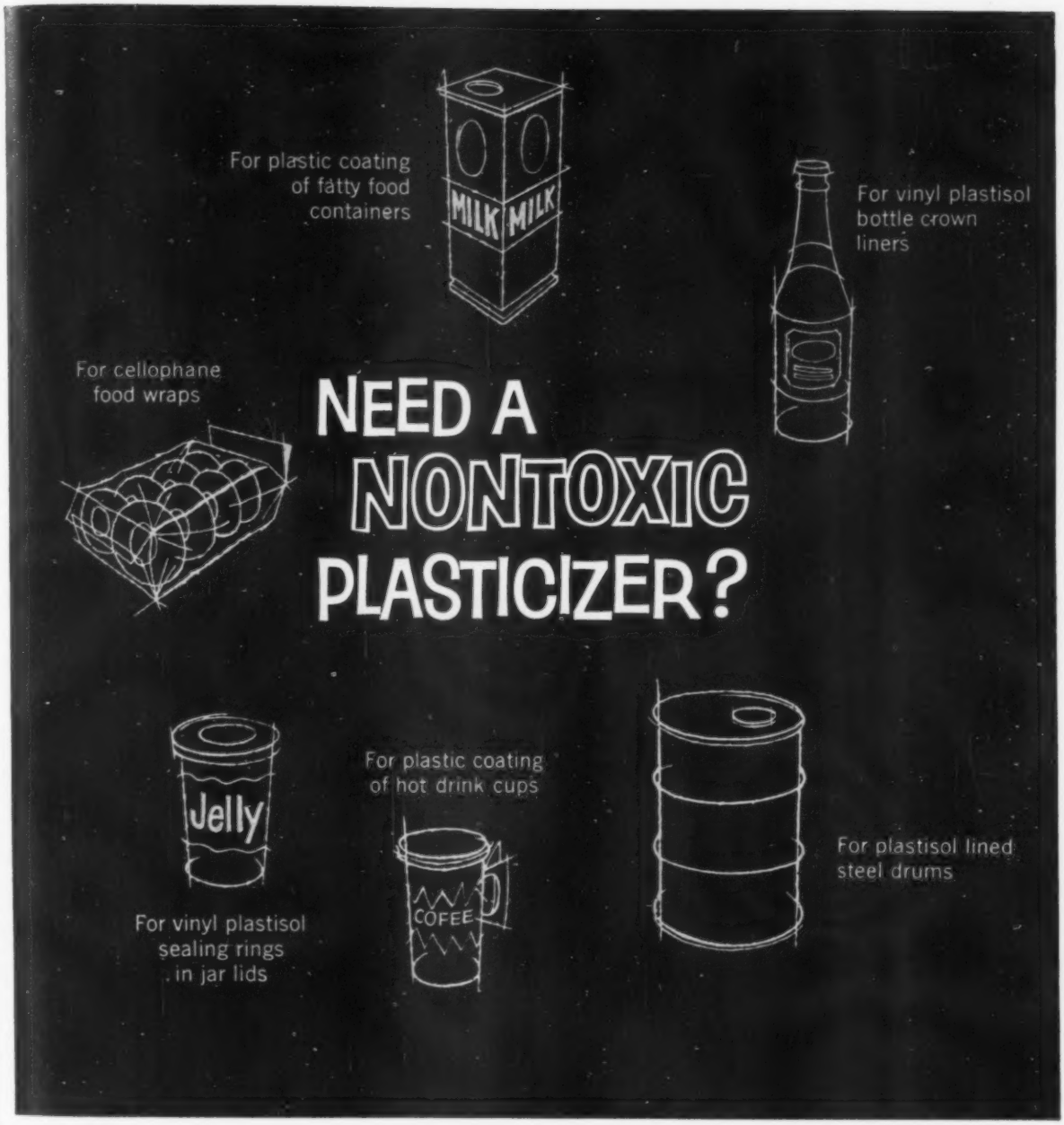
For plastic coating of fatty food containers
MILK
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For vinyl plastisol bottle crown liners
For cellophane food wraps
NEED A NONTOXIC PLASTICIZER?
Jelly
For vinyl plastisol sealing rings in jar lids
For plastic coating of hot drink cups
COFEE
For plastisol lined steel drums

The low cost of Pfizer CITROFLEXES® will surprise you!

For all these and many other plasticizer applications you should investigate the nontoxic, odorless Pfizer Citroflexes.

Citroflex A-2 (Acetyl Triethyl Citrate) for cellulosics is especially suited for use in plastic food wraps such as cellulose acetate packages for processed meats, doughnuts, etc.

Citroflex A-4 (Acetyl Tributyl Citrate) for polyvinyls is used in such vinyl products as food container coatings, bottle crown liners and for food-jar-cap sealing rings.

Both Citroflex A-2 and A-4 are nontoxic and odorless. They are accepted by the Food & Drug Administration for use in plastic packaging of both fatty and non-fatty foods.

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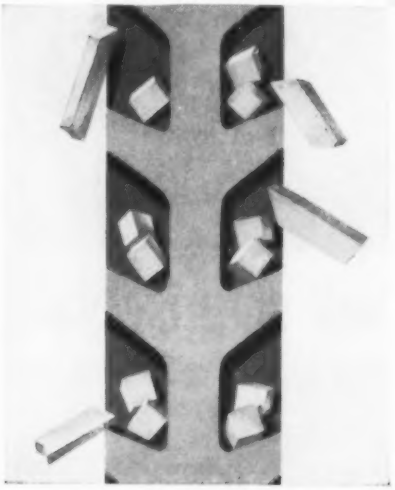
Lately more plastics materials are being sized and separated by Simon-Carter machines

CARTER GRADERS PERFORM THICKNESS, WIDTH SEPARATIONS

For sizing or separating free-flowing granular materials by *thickness*, Carter Precision Graders use revolving cylinders with *slotted perforations at the bottom of grooves*. Saddles between these grooves upedge the materials presenting them to the slots in an edgewise position. The thinner pieces pass through and the thicker pieces pass over and are conveyed to the end of the machine.

For *width* sizing or separating the Precision Graders use revolving cylinders with *round recessed perforations*. The recess causes the materials to be presented to the round perforations in an upended position. Narrow pieces pass through and wider pieces pass over for discharge at the end of the cylinder.



CARTER SEPARATORS ASSURE POSITIVE LENGTH SEPARATION

Carter Disc Separators contain a series of discs mounted on a revolving horizontal shaft. Each disc has hundreds of undercut pockets which select or reject plastics or similar materials according to *length*. As the discs revolve through a mixture of materials, the pockets lift out the shorter pieces. The longer pieces, too long to be held in the pockets as they rise, drop away from the discs.

Write today for complete information and descriptive folders on Simon-Carter machines.

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659 Nineteenth Ave. N. E. • Minneapolis 18, Minn.
Successor to Hart-Carter Co., Minneapolis Division

The Plastiscope

chemical intermediates or monomers, such as acrylic esters, acrylamides, vinyl esters, and amides.

British Plastics Institute journal

The "Transactions and Journal" of The Plastics Institute, 6 Mandeville Pl., London, W.1, England, will be published six times a year, instead of four, in the future to permit a more topical presentation of announcements and speedy publication of priority papers. The publication has also changed its format, and is redesigning the cover, layout, and presentation of editorial matter.

S.P.E. Baltimore-Washington Section

The following program for the 1958-1959 season has been announced by the Baltimore-Washington Section of Society of Plastics Engineers, Inc.:

1958: Oct. 14—Baltimore, Md. *"Plastics in electronics."* **Nov. 18**—Washington, D. C. *"Advances in graft and block copolymerization."* **Dec. 9**—Baltimore, Md. *"Ladies Night—Synthetic fibers in rugs."*

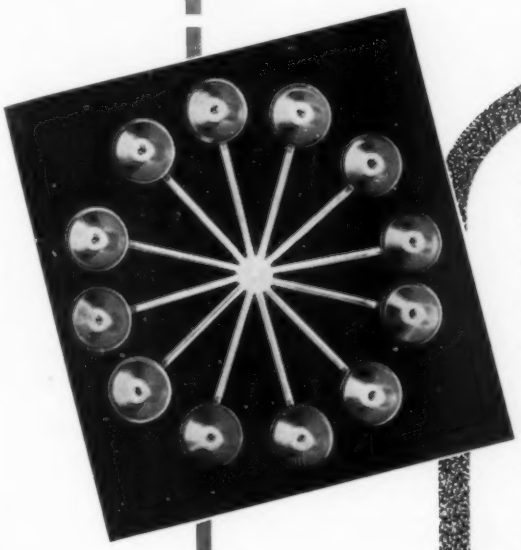
1959: Jan. 13—Washington, D. C. *"Role of chemical finishes in reinforced plastics."*—(Panel discussion). **Feb. 10**—Washington, D. C. *"Rand process-filament winding."* **Mar. 10**—Baltimore, Md. *"Plastics in packaging."* **April 14**—Washington, D. C. *"Technical forum."* **May 12**—Washington, D. C. *"Science Fair awards."*

Product design course

Stevens Institute of Technology, Hoboken, N. J., is offering a course in plastic product design every year during the fall semester. Thermosetting and thermoplastic materials, including their structural, chemical, and electrical properties will be studied. Design factors such as moldability, fabrication limitations, dimensional stability, low and high temperature effects, compatibility, and aging will also be discussed.

Allen Shibley of Picatinny

Polythene cone lined CLOSURES



. . . made by JOHN DALE LTD., New Southgate, London N.11, afford the perfect method of closure. They can be sealed, unsealed and re-sealed by the slightest twist. Though resilient to conform to the mouth of the container they are tough enough for high-speed capping machines. Chemically inert and solvent resisting, the polythene liners must be precision molded to the closest tolerances. For trouble-free rapid precision molding, John Dale Ltd. rely on

600 shots per hour
12 impressions
7,200 liners per hour

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Capacity 30 grams · 22 grams in nylon

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The low-cost SNOW PLASTICS CUTTER solves this problem ideally—slices materials up to 24" by 24", with thicknesses depending on individual materials. Check these features:

SAFETY is the first consideration. It is easier to run the SNOW PLASTICS CUTTER safely than haphazardly. The control valve requires the operator to have his hand on it absolutely at all times; the instant he removes his hand, the blade comes to an instant stop. The blade cannot creep or drop. With this "fail-safe" equipment, workers do better and more rapid cutting.

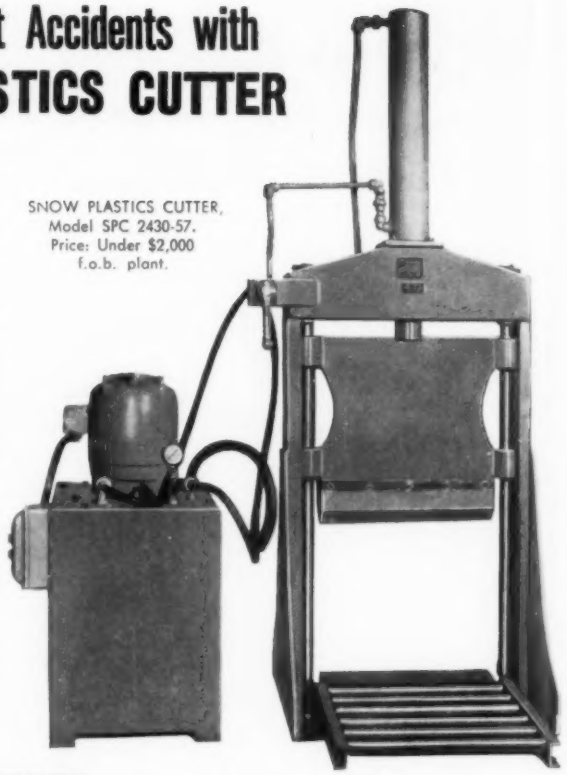
DESIGN is simple and effective. Welded frame; four bearing supports; the knife rides on ground rods. A positive stop control gives positive action for depth of cutting.

CUTTER BLADE is bolted on for easy removal to sharpen. Low cost to replace after long use.

POWER CYLINDER is made of finest tubing, properly micro-honed. Bronze packing nut with 'O' ring; chevron packing on piston gland to prevent leakage. Cylinder is 5" diameter with 24" stroke. Cylinder rod chromium plated for greater life.

CONVEYOR on rear has ball bearing rollers, (permanently lubricated). Makes for easy advance of bale into cutter to control thickness of slice which may be thick or thin.

Write today for full details!



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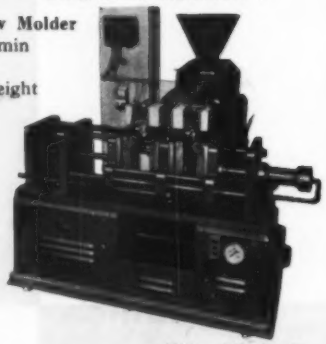

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Maximum extruding quantity 2oz.
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Whenever you see editorial matter of this type in *Modern Plastics* magazine or the Encyclopedia Issue which you can use in reprint form, in quantities of 200 copies or more, write and quotations will be furnished promptly.

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The Plastiscope

Arsenal teaches the class which meets on Thursday evenings. The course is open to men with a high school education. The tuition fee is $50.

Foam indicator

A new technique for measuring the "setting" characteristics of vinyl plastisol foam before it is fused has been developed by Dr. Harvey Alter of Bakelite. His method uses an "Ultra-Viscoson" viscometer to measure the viscosity of the plastisol and a thermocouple for the temperature. Output is fed to recording equipment and the curves tell whether a foam made from that formulation will fuse or collapse. About 1½ hr. are needed to determine whether or not the formulation is suitable, and provides for proper formulation without guesswork or inadequate gel data.

Polyethylene laundry packaging trends

Despite the fact that polyethylene was rated the most expensive packaging material used in the laundry and drycleaning industries, a survey conducted by the editors of *Cleaning & Laundry World* indicates that the industry is switching from paper and cellophane to polyethylene mainly because the plastic material has greater customer appeal. It was also rated the most protective packaging material.

Some 35,000 cleaning/laundry plants in this country are said to use more than 9,250,000,000 packages annually. More than 2 billion are used for short and long coats, almost 7 billion for shirts, and some 250 million for sweaters.

Of the companies which participated in the survey, 62% already use polyethylene for packaging drycleaning items; 38% use paper; and of the 36% which will change their packaging, 30.6% will switch from paper to polyethylene. Paper is most widely used in the packaging of laundry items where it supplies 85% of the market, whereas polyethylene is preferred by only 13.3%, and cellophane is

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For over three decades we have specialized in the manufacture of organic peroxides. Today our peroxides are outstanding in quality and closely controlled uniformity. During all these years we have maintained a progressive program of research and development work for the purpose of making organic peroxides and their compounds available to industry in the form best suited to each particular application. We are confident that in the groups of organic peroxides listed below you will find the key to some of your processing problems.

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Gives uniform blend every time to end products. Accurate feeders assure exact matching of batches.

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No need to tie up money and precious floor space in prepared raw materials in numerous colors. All you need is color concentrate and clear or neutral plastics.

Write for new two-color bulletin with complete information and money-saving applications for the 129.

anti-wrinkle slat expanders
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If you'd like to forward your copy of last year's issue to such a student—the new edition is either on its way to you now or already in your hands—just fill out the coupon and mail it to us. We'll send you, in return, the name of a student or instructor who wants your book—with an address label all made out. You can send the old book on to him in the same carton in which you receive the new issue!

Joel Frados
EDITOR

MODERN PLASTICS ENCYCLOPEDIA ISSUE

P.S. The response of MODERN PLASTICS' subscribers to previous requests for student copies has been truly enthusiastic. Over twelve thousand copies of earlier Encyclopedia Issues have thus far been distributed to students in our schools and universities!

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running a poor third, supplying only 1.7% of the total.

Among present users in the industry, 78.6% supply polyethylene packages as a standard service, mainly using ready-made bags.

Adhesives

Contact cement. A non-flammable, water-thinned adhesive reported to be capable of giving instant high-strength bonds between decorative high pressure laminates, glass, hardboard, metal, and wood, is available from the Structural Products Div., National Starch Products, Inc.

Designated Instant-Lok 4300, the adhesive is said to possess the bonding properties usually associated with solvent-based systems, but offers many safety advantages, and savings in equipment costs. It is claimed that utilization of the new material eliminates the need for ventilating hoods and spray booths. Instant-Lok 4300 can be heat-reactivated where combining is not done the same day as coating, the company states.

Epoxy adhesive. A one-part 100% epoxy adhesive, designated Isobond 321, is available from Isochem Resins Corp., Providence, R. I. It is said to offer all the properties of the most tenacious epoxy bonding material, but to eliminate mixing, weighing, and metering required for the two-part epoxy adhesives.

Isobond 321 is a true thixotropic paste. Short heat curing is required. The electrical insulation properties are excellent, the company claims.

Shipment is in 1 gal. cans at $1.70/lb. or in 5-gal pails at $1.56/lb. Isobond 321 weighs about 9 lb./gal.

For polyethylene laminations. Specially formulated adhesion promoters or primers to facilitate strong and durable bonds between polyethylene and paper, foil, Mylar, saran, and other materials common in the packaging

U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

Packaging Notes

New Shock-proof Package has been developed for dropping medical supplies by air without the use of parachutes. The package features a flexible tube of polyethylene twist-suspended inside a fiber case by means of rings attached to the case. In addition to drop tests, the package has been subjected to water-spray and other tests.

Although developed primarily as a drop case for military and disaster use, the package has attracted the attention of electronic tube manufacturers and instrument makers as a replacement for the more costly and less safe packaging now in use.

Polyethylene and Steel Returnable Container for the shipment of corrosive chemicals is now being marketed. The container features a polyethylene inner container with a steel drum outer jacket. Compared with conventional glass carboys, the new container is claimed to have a lower package cost, lower tare weight, and less cubage . . . with consequent savings in freight and handling costs. Container is being made in two sizes: standard weight 14 gallon with 5¾ pound inner container, and the heavy-duty 13 gallon with 8¾ pound inner container.

Polyethylene Zippers are being used on filter cloth bags. The zippers are jam-proof and corrosion-resistant. The poly zipper strip is sewn to the cloth with a special stitch that prevents leaking. Zippers ride in smooth grooves with no teeth to snag or collect dirt. Closure is said to withstand 80-pound pull.

Self-venting Poly Closures for Drums eliminate the need for separate vents on containers used to ship liquids. The venting feature is an improvement on the retractable polyethylene spout familiar to users of liquid chemicals in metal drums.

The improved spout prevents liquid surge or "glug" in pouring. It is claimed that there is no waste or spillage, since the closure will vent in any pouring position. The polyethylene cap for the new spout also features a small bail to facilitate pulling the spout up into pouring position.

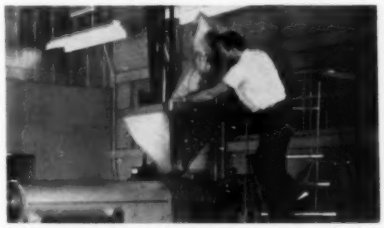
Self-venting flexible spout pours easily from any position. Picture shows spout being raised into pouring position via new bail on reseal cap.

New Petrothene® Shut-down Resin Solves Problem of Post-startup Rejects

Eliminates High Temperature Degradation of Resin Left in Machine

A special shut-down resin is being made available as a service to customers by U.S.I. Intended for use immediately before shut-down, this material is designed to prevent the high temperature degradation that is usually encountered in polyethylene processing equipment during normal shut-down and start-up procedures.

When a machine operating on conventional resin shuts down, the product immediately after start-up is usually unsatisfactory. Gels, fisheyes, discolored particles, and other evidences of resin deterioration show up, not only in the initial production, but sometimes for hours afterward. The reason: Resin in some parts of the machine is held too long at too high a temperature. Thermal degradation results.



Adding Petrothene 205-1 to purge the production resin from the machine just prior to shut-down eliminates usual waste at start-up.

U.S.I.'s answer to the problem is PETROTHENE 205-1, a specially prepared resin that will withstand prolonged exposure to high temperature. When this material is in the machine during normal cooling and heating periods before and after shut-down, minimum thermal degradation takes place.

The technique for using the resin is simple. A few minutes before shut-down the special resin is fed to the machine. When the normal resin has been purged, the machine can be shut down. There is little or no waste and no after effect in the machine when the new resin is used.

PETROTHENE 205-1 is supplied in pellet form, packed in 50-lb. bags. Full details about this special shut-down resin may be obtained by contacting your nearest U.S.I. office.

New Resin for Poly Pipe Wins NSF Approval Seal

A new U.S.I. polyethylene resin — "Petrothene" 102-216 — has been given the National Sanitation Foundation Seal of Approval for use in potable water supply pipe. Pipe made with the new resin has given outstanding results in tests conducted at U.S.I.'s Research and Development Laboratory. Minimum quick burst pressure was 15 to 20% above the minimum required under the Department of Commerce specification CS197-57. No failures were encountered in the slow burst test or in 96 hours of stress crack testing. Information on this resin and other NSF-approved PETROTHENE resins may be obtained from your nearest U.S.I. office.

Visit U.S.I. in Booth 501, Nat'l Plastics Exposition

Quality control as a joint responsibility of the resin supplier and his customer is the theme of U.S.I.'s exhibit this year. "Live" tests on resins, laminates, molded and extruded items are highlighted. A special feature is an information booth manned by U.S.I. technical service men to answer questions on polyethylene production and application problems. Be sure to visit U.S.I. in Booth 501!

Polyethylene plus Glass Fiber Yields New Basic Film Material

Polyethylene is now being reinforced with glass fiber to produce a new film that combines the advantages of both these materials. The film, reinforced with non-woven glass fabric, is at present being made in a range of gauges and in clear and black.

Glass fiber reinforcement gives dimensional stability to the film, so that it does not stretch or billow. It also increases the film's break, burst, and tear strengths, which gives the film longer life in rugged applications and makes possible the use of thinner films. Four-mil reinforced film is said to more than do the job of 6-mil unreinforced film.

Other advantages cited include easier repair because any tears or rips are localized, easier heat sealing because films are thinner, higher grommet strength, and low cost.

DO YOU HAVE a new polyethylene packaging development you'd like the industry to know about? Make it routine to send your information on new developments to U.S.I. POLYETHYLENE NEWS.

Address the Editor,
U.S.I. POLYETHYLENE NEWS, U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corp., 99 Park Avenue, New York 16, N. Y.

U.S.I.

Vol. III No. 5

POLYETHYLENE PROCESSING TIPS

HOW TO MINIMIZE NECK-IN IN EXTRUSION COATING AND FLAT-FILM CASTING

Extrusion coaters and film makers working with polyethylene are frequently faced with the costly and bothersome problem of "neck-in" during draw-down of the hot melt web between the die and the nip or casting roll.

It is accompanied by "beading," or thickening of the melt at both edges of the coating or cast web. As the roll is wound up, the weight of the coated sheet or film is supported by the two beads. This results in a soft roll, sagging in the middle, or in possible breaks in the taut edges of the substrate. Excessive neck-in means trimming the edges of the sheet, with a considerable loss of usable web width and material.

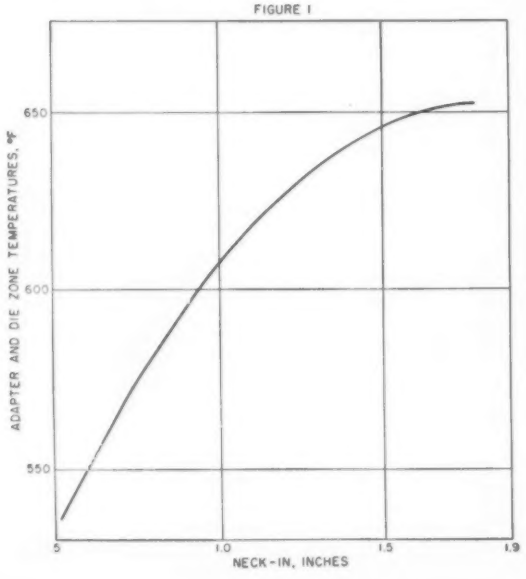
Because of the interest in minimizing neck-in and beading, the Technical Service Laboratory of U.S.I. has carried out research on this condition. The work has established that neck-in is dependent on both machine conditions and basic resin properties. It has also established a number of steps which can be taken to reduce neck-in.

Machine Conditions Which Reduce Neck-In

Neck-in is mainly a function of three machine variables—draw-down distance between die lips and chill roll, die setting and die zone temperature.

In flat-film casting, neck-in decreases rapidly as draw-down distance decreases—roughly ¼ in. per inch of draw-down distance.

FIGURE 1



Neck-in decreases as the die setting decreases. In one instance, U.S.I. engineers found that average neck-in decreased by 0.4 in. as the die setting was decreased from 20 to 10 mil, all other conditions remaining equal.

Neck-in also decreases when adapter and die zone temperatures are kept low compared with barrel zone temperatures. Figure 1 illustrates this effect. In this test the average barrel zone temperature was kept constant at 607°F. When adapter melt temperature was lowered from 607° to 550°F, neck-in on each side decreased roughly from 1.0 to 0.6 in.

Resin Conditions Which Reduce Neck-In

U.S.I. engineers have found that neck-in increases with density and the logarithm of the melt index. As melt index increases, average molecular weight decreases. The resin becomes less viscous and has a greater tendency to neck-in at the sides during draw-down. For this reason, temperatures at both ends of the die are often kept lower than at its center.

Minimizing Neck-In Is Often Difficult

Machine conditions and resin properties which reduce neck-in cannot always be utilized fully because they may affect other essential properties or economy adversely. A few examples follow:

- While comparatively *low* adapter and die temperatures have a reducing influence on neck-in, good adhesion to the substrate depends primarily on *high* stock temperatures.

- And while neck-in can be considerably reduced by using a polyethylene of *lower* density, *higher* density improves moisture resistance, impermeability to oxygen, chemical resistance, stiffness, strength and other properties which may be essential.

- A combination of low density and low melt index will result in minimum neck-in, but unfortunately there is an optimum combination below which voids in the hot web will occur at high operating speeds.

It is obvious that neck-in is not an easy problem to solve, and must be dealt with on a compromise basis. U.S.I. Technical Service engineers are available at all times to work with extruders toward minimizing this troublesome condition.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N.Y.
Branches in principal cities

industry, have been introduced by National Adhesives Div., National Starch Products, Inc.

When applied to the substrate, the primers are said to permit polyethylene extrusion at lower temperatures than were formerly possible—in many cases a drop of 100° F. can be effected, the company states. By utilizing primer-coated stock, saran coat lifting, a direct result of high extrusion temperatures, is completely eliminated, it is claimed.

The primers find application in extrusion-coating of polyethylene, and in converting of polyethylene-coated papers into bags, pouches, other forms of packaging. They are said to give more slip, lower odor, better aging, and heat seal bonding.

Epoxies

Anhydride curing agent. Electronic Plastics Corp., 671 Barbey St., Brooklyn 7, N. Y., reports that using an anhydride curing agent results in an epoxy potting compound with a higher heat distortion temperature (up to 209° C.), better electrical characteristics, and easier workability than amine-cured epoxies.

According to the company, anhydride-cured epoxy formulations are ideal for mass production setups, where the longer pot-life permits full automation. An experimental arrangement at EPC, for example, feeds a full day's supply from a cylindrical reservoir, which has a built-in fan and heater to adjust the viscosity for optimum flow.

Hexahydrophthalic anhydride, and methyl Nadic anhydride, both available from National Aniline Div., Allied Chemical Corp., are being used as curing agents by Electronic. Hexahydrophthalic anhydride is a solid which melts upon slight heating; methyl Nadic is a liquid at ambient temperatures. Both are said to be compatible with almost any epoxy resin.

The low viscosity and long gel-

(*To page* 338)

profiles in plastics

By **BARTO L. ATTIG,** *Sales Manager*
AMERICAN INSULATOR CORPORATION
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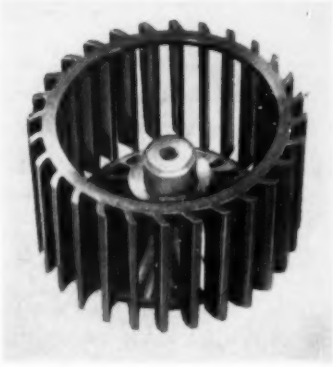

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Lettering to be molded on part should be on surfaces parallel to the parting line, sides of characters should be well tapered. Character depth of 1/64-inch is considered adequate . . . depth of 3/64-inch is maximum recommended. Confine lettering to flat surfaces, lettering on curved surfaces requires a split die or complicated die making. Additional information on lettering is fully covered in Aico's Plastics Designer's Handbook. Coupon will bring your FREE COPY.

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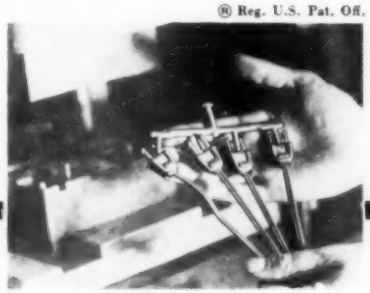
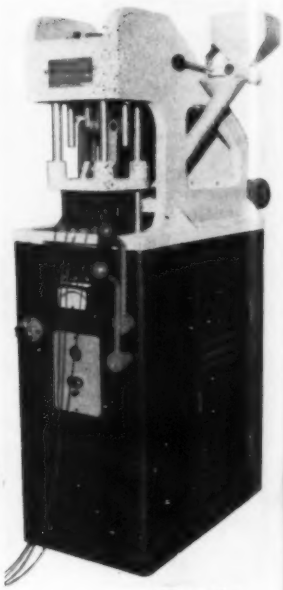


Four cord endings made with one shot, just as they come out of the mold with sprue and runners attached.



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Here's important, money-saving news for molders of small plastic parts involving inserts or loose cores. The new "Eldorado" MINI-JECTOR is especially engineered to produce precision parts *quicker —at less cost!*

The "Eldorado" MINI-JECTOR offers larger mold area (6″x5″x5⅛″) for inserts or loose cores than "Wasp" type MINI-JECTORS. Retains every advantage of smaller machines, plus many more for fast, profitable production.

You'll like these exclusive advantages:

No Tie Rods in Way—"Eldorado" MINI-JECTOR is engineered so no tie rods in front hinder operator's free access to mold when it is open. Yet it has ample clamping pressure.

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See the "Eldorado" MINI-JECTOR in Booth 701 at Plastics Exposition

For complete details on new "Eldorado" MINI-JECTOR write for Bulletin E.

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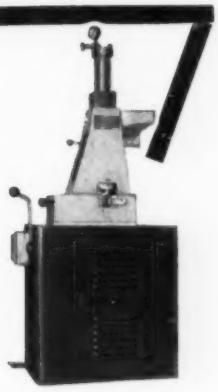

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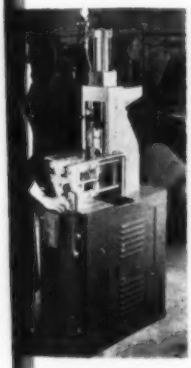

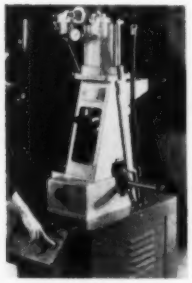

MINI-JECTORS are offered in many variations to meet your special requirements.

MINI-JECTOR users report these valuable advantages

- Mold costs are very low (blanks as low as $29.50)
- Initial investment is small (some under $1,000)
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- Produces a wide variety of small items (1/3 to 1½ oz.)
- Molds all thermoplastics, including Nylon
- Even short or moderate runs—too costly on big presses—are profitable on MINI-JECTORS
- Molds interchangeable quickly. In "Wasp" model MINI-JECTORS, molds instantaneously removed by pressing a knob.

To our Spanish-speaking Friends—For your convenience, we are preparing condensed information on MINI-JECTORS in Spanish. In writing, please tell us as much as possible about your interest so we can give you complete data.

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ation period of the anhydride-cured epoxy are said to be useful for casting, as they permit entrapped air to escape before the formulation hardens.

Resin for volume casting. A two-component, black, epoxy-based liquid casting resin for the mass production of solid cast dies, pottings, epoxy faced dies, keller patterns, etc., is available from Hastings Plastics, Inc., Santa Monica, Calif.

Called Maskast, the new resin is said to be an easy pouring, rapid curing material, whose hardness and resiliency can be controlled within limits, by varying the amount of hardener (Tufset) used.

Maskast is packaged 15 lb./gal. in bulk containers of 1 qt., and 1, 5, and 55 gal. containers. It is priced at 65¢/lb. in large container. Tufset mix, used 15 parts to 100 parts Maskast by weight, costs $1.25/lb. in large quantities.

Surface coatings

New PVAc emulsion. A polyvinyl acetate emulsion, specifically designed for use as the vehicle in gloss and semi-gloss water based paints is now being produced by Shawinigan Resins Corp., Springfield, Mass.

Designated GELVA Emulsion TS-66, the new product is expected to open the estimated $200 million annual retail market for interior gloss paints to PVAc systems, the company states. The main problems of water based gloss paint—lasting hardness of the paint film and durability of gloss even after frequent washings—are said to have been overcome with the new emulsion.

Vinyl coating. Linen-textured vinyl coatings used on 12-watt amplifiers have proved superior to anodized or other existing finishes, according to Heath Co., Benton Harbor, Mich.

Sun Steel Co., Chicago, Ill., applies the vinyl by a new system of coating metal in the flat and

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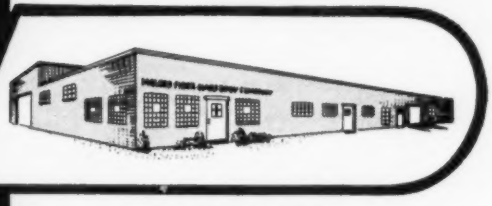

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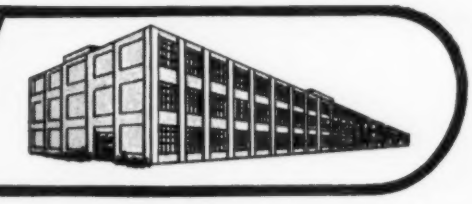

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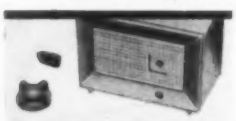

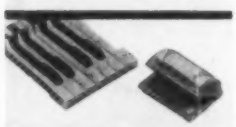

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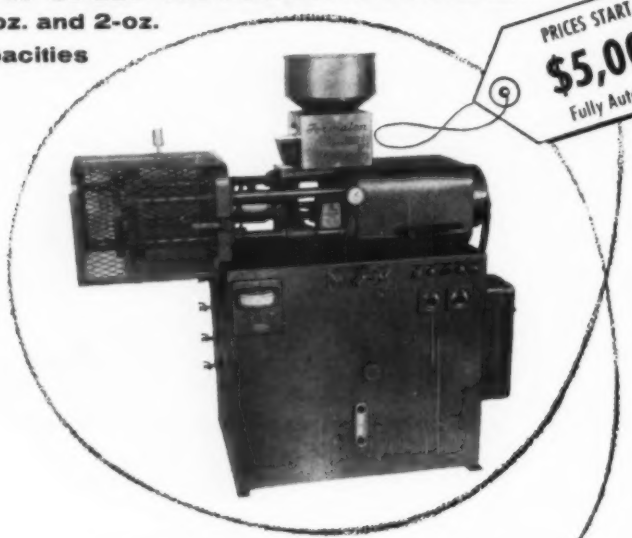

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then forming it. This method is said to cut time previously required to enamel-spray the formed material and, at the same time, produces a better finish.

The coating, based on vinyl resins supplied by Bakelite Co., Div. of Union Carbide Corp., virtually eliminates the danger of electrical shocks from Heath amplifier cabinets by resisting electrical loads up to 7000 v., according to Bakelite.

Heat-seal coating. A vinyl-type heat-seal coating for aluminum foil and paper has been introduced by Gordon Lacey Chemical Products Co., 57-02 48th St., Maspeth, N. Y. Designated H 197 W, the new material is said to permit sealing of coated side to coated or uncoated side. It can also be sealed to vinyl, saran film, cloth, cellophane, and to Mylar, the company states.

The product is reported to provide good chemical resistance properties. Since the ingredients used in formulating it are said to be non-toxic and the coating resists greases, oils, and fats, it is expected to be useful in packaging food, drugs, soaps, and chemical compounds.

Conventional coating equipment, such as roller, knife, and engraved roll can be used for applying the coating to foil or paper. An oven operating at 200 to 275° F. is required to dry the coating in several seconds, the company states.

Plastics paints. The part that resins are playing in the paint industry was illustrated by Bakelite Co. at the recent Paint Industries Show in Cleveland, Ohio. A company display highlighted the use of vinyl dispersion finishes before application to metal sheets before forming products; a new vinyl latex for improved adhesion over chalky surfaces; a new metallic hammer finish latex coating; and commercial applications for epoxy troweling compounds.

Vinyl dispersion finishes for metal products have grown in

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volume over the past years, because of the good abrasion resistance, chemical resistance, flexibility, toughness, and color retention of these coatings. Now, with the raw material cost down to where dispersion coatings are competitive with other baking finishes, they are particularly suited for business machines, office partitions, and appliances, according to Vernon L. Larson, Bakelite's assistant sales manager of surface coating materials.

A vinyl maintenance finish used over phenolic primers on bridges, plant buildings, and similar installations was also exhibited. Bakelite, in addition, displayed a new drier system that is said to make thicker coats possible with cold-mix phenolic varnishes.

Samples of various air-dry troweling compounds made with epoxy resin were another exhibition feature. Their potential is thought to be in industrial non-skid flooring, concrete coatings, and flooring for school buses, and other public conveyances.

Expansion

Marbon Chemical Co., Div. of **Borg-Warner Corp.**, has moved to its multi-million dollar plant in Washington, W. Va. General sales offices, research laboratories, and general administration departments will be located in a new center adjacent to the firm's Woodmar plant, which has been in production for over one year. Production operations at the company's Gary, Ind., facility will continue.

Monsanto Chemical Co. has announced that new facilities for manufacturing rubber-modified styrene at its Plastics Div. plant, Springfield, Mass., by an improved process are now in full operation. This expansion more than doubles the company's capacity to produce polystyrene in medium- and high-impact formulations.

According to Monsanto, molding grades of these materials are

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HEAT-ASSIST, AIR HYDRAULIC

DIE-CUTTING PRESS

NEW!

TRONOMATIC CREATES A NEW APPROACH TO DIE CUTTING

A new concept in die cutting, permitting nearly unlimited cutting lengths by use of controlled heat, combined with HIGH force at speeds comparable to mechanically operated presses. Accommodates both sheet plastic and complete multiple blister or skin package cards. LOW DIE COSTS . . . utilizes ordinary steel rule dies. HIGH QUALITY PRODUCTION . . . HIGH SAFETY OF OPERATION . . . LOW MAINTENANCE COSTS.

Available in 2 standard sizes (cutting area: 24"x36" or 30"x50"), or custom-engineered to meet your requirements.

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QUALITY: Highest-Uniform

EFFICIENCY: Spray tailored for mold release use.

AVAILABILITY: Stocks in key cities.

ECONOMY: Check these prices.

1 to 11 cans	$1.60 per can
1 to 4 cases (12 cans each)	$16.80 per case
5 to 9 "	15.60 " "
10 to 24 "	14.40 " "
25 or more cases	13.20 " "

20 OZ. GIANT CAN

DON'T DELAY! ORDER TODAY!

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MOLD THIS POWDER AT 300°F

When the powder manufacturer says 300 degrees, he means 300 degrees, not 285 or 315. With the Cambridge Mold Pyrometer, the surface temperature of mold cavities is quick and easy to determine, and thus control. The routine use of the Cambridge Mold Pyrometer will go a long way in preventing off-colors, brittleness, warpage, soft centers and low tensile strength. It is an accurate, rugged, convenient instrument that molders like and will use.

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Bulletin 194—S gives details of these instruments. They help save money and make better plastics.

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STYRON 480

for super impact, detailed reproduction

When it comes to manufacturing this new relief globe, Styron* 480 offers the ideal combination of required properties. The globe must be reproduced with precise accuracy. It must be light-weight, but sturdy enough to take hard use in classrooms . . . and inexpensive enough to fit into school budgets.

The two hemispheres are vacuum formed of Styron 480 sheet, and they make the most of its outstanding forming characteristics. For the first time, mountains, valleys, rivers and plains are reproduced on a globe in accurate relief. Super high-impact strength and light weight make for easy handling, and students can color it with water paints, wash it and paint it again.

There's a world of manufacturing and marketing advantages in the Dow family of thermoplastics, which includes 12 Styron formulations. And with every Dow plastic you get uniform quality, prompt delivery and expert technical assistance. It will pay you to see your Dow man soon.

THE DOW CHEMICAL COMPANY, Midland, Mich., Plastics Sales Dept. 1536A-1.

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From relief globes to radio cases—
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The famous family of Dow plastics is rapidly making a name for itself around the world.

Readily available to manufacturers in Europe . . . in Latin America . . . in the Far East . . . Dow plastics' raw materials are improving products and processes for home and industry.

Products of extensive Dow research, they offer the same dependable quality to every field they serve. For colorful products for the home . . . for industrial applications . . . for coatings . . . for modern packaging . . . look to Dow plastics for the *right* plastic to meet your needs.

Your local Dow representative or the Dow branch office in your area will be glad to give you complete information on any of the Dow plastics.

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DOW

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characterized by softer flow and faster set-up in the mold; extrusion compounds permit higher production rates of smooth, fine grained sheets with uniform physical properties.

Asahi-Dow Ltd. has a styrene monomer plant under construction which will supply the existing raw material needs for polystyrene production in Japan, with additional capacity available for synthetic rubber production.

The new plant is located at Tokyo Bay's huge refining and petrochemical center in Kawasaki, and is expected to go on stream early in 1960.

Asahi-Dow was formed six years ago by Dow and **Asahi Chemical Industry Co. Ltd.**, a leading chemical manufacturer in Japan, to produce saran, saran filaments and polystyrene. The associated company operates saran manufacturing plants in Nobeoka and Suzuka and a polystyrene plant in Kawasaki.

Shell Chemical Corp. will begin construction of a phenol unit at its Houston, Texas, plant early in 1959. Most of the unit's production will be used to manufacture bisphenol A, one of the two principal ingredients in the company's Epon epoxy resins. Shell Oil Co. also will take a share of the phenol.

The unit, scheduled to be completed in late 1959, will produce acetone as a co-product.

H. B. Fuller Co., St. Paul, Minn., will erect a new adhesive manufacturing plant in Fairfax, Kans. The building is slated for occupancy around February 1, 1959. Fuller currently occupies a building in Kansas City, Mo., the company's first branch plant.

Standard Packaging Corp., New York, N. Y., has purchased the assets of **Basca Mfg. Co.**, Indianapolis, Ind. This acquisition—Standard's third this year—pro-

(*To page* 348)

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VISCOSITY REDUCTION
VISCOSITY STABILIZATION
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PLASTISOLS
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ORGANOSOLS
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No. 103 Flash Lathe

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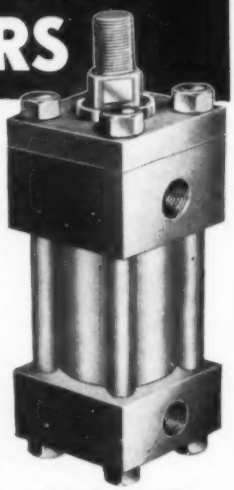

Eliminate costly production delays—speed-up your design and replacement programs—with this greatest quality selection ever offered on such fast delivery service. Choose from over 15 popular mountings, strokes up to 36", cushioned and non-cushioned. *Price savings up to 5%!*

AIR CYLINDERS, 250 psi, 1½" through 8" bores.

HYDRAULIC CYLINDERS. Job-Rated Model "J" for 500-2500 psi operation, 1½" through 8" bores. Power-Packed Model "H" for 3000-5000 psi, 1½" through 5" bores.

Larger bores (up through 20" air, 14" hydraulic) and longer strokes (up to 22 feet) available on longer delivery.

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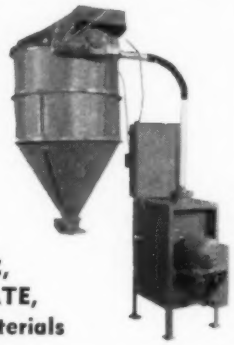

This Goulding engineered design of tube-type revolving agitator provides high-efficiency drying and blending by hot air forced through main shaft and arms. Hopper is mounted with special adapter for use on in-feed end of extruder. All steel construction. Approximately 600 lb. capacity. Complete with electric control panel as illustrated. Other capacity extruder-hoppers available. Specifications, prices and delivery data upon inquiry.

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- **Highest Speeds**

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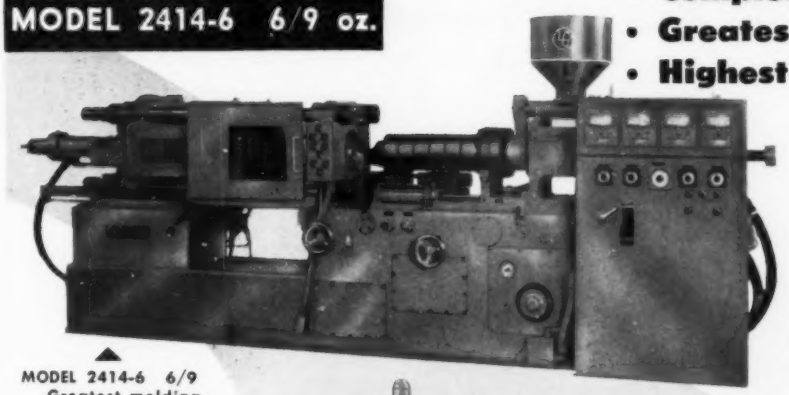
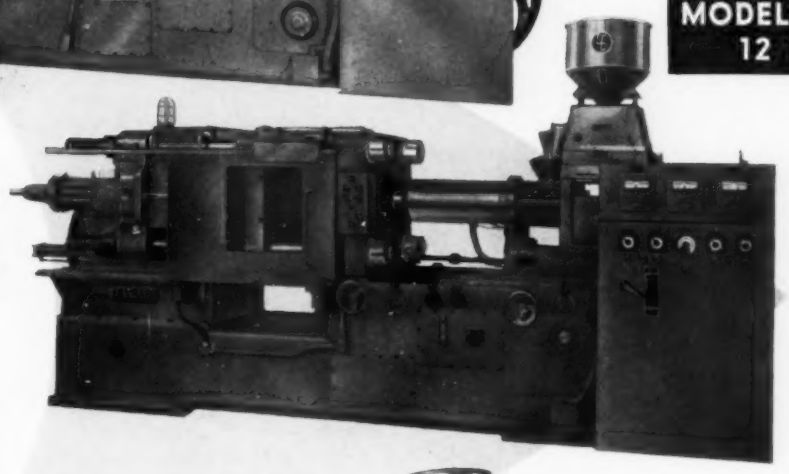


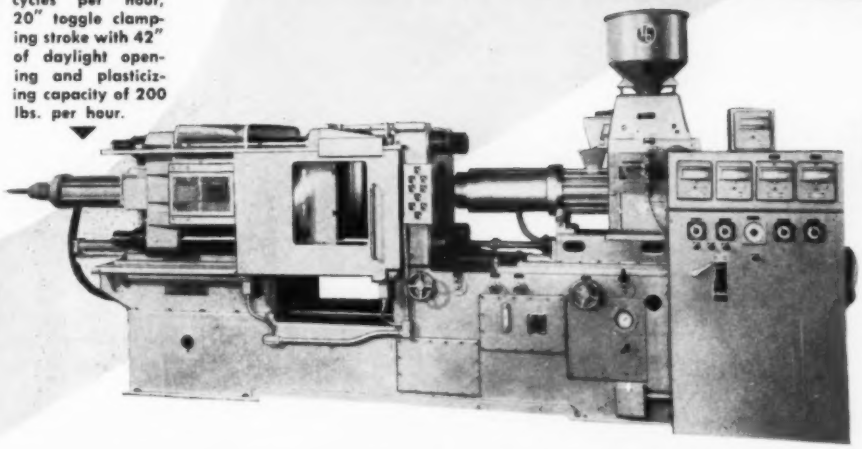
MODEL 2414-6 6/9
Greatest molding machine development in years.

MODEL 3214-12 12 16 oz.



MODEL 3214-12 12/16
Die space (720 square inches), more daylight opening (42") and more plasticizing capacity (150 lbs. per hour) than any other 12 oz. press.

MODEL 3220-16 16/20
Compare these features — 420 dry cycles per hour, 20" toggle clamping stroke with 42" of daylight opening and plasticizing capacity of 200 lbs. per hour.



MODEL 3220-16 16/20 oz.

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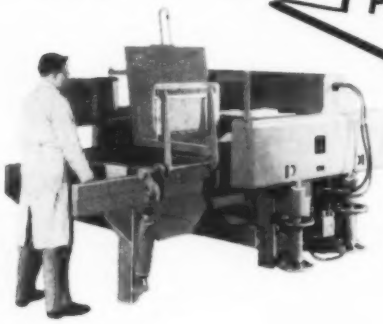
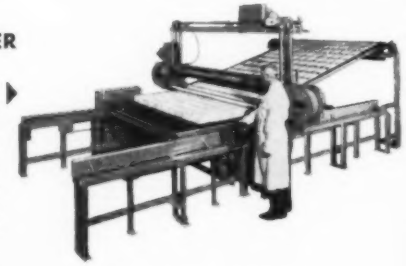


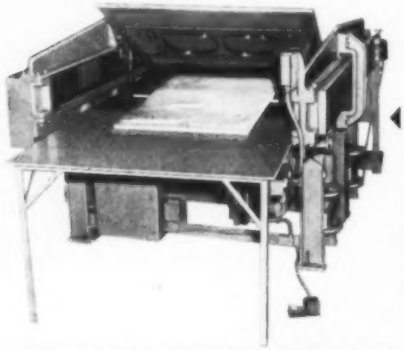
"Roll Lift" AUTOMATIC TRIMMER

Automatic in operation, complete cutting cycle in 20 seconds, revolutionary, low cost method. For trimming vacuum formed packaging materials, plastic and synthetic foams such as urethane, latex foam rubber, cardboard, cork, etc. We make trial cuts on your stock without obligation.

Automatic LEVELER and SPLITTER with TAKEAWAY CONVEYOR

Levels and splits plastic foam materials. Takeaway conveyor allows continuous operation, no stopping to remove cut materials. 84 x 110 machine shown here completes cutting cycle in 20 seconds. Entirely automatic, designed for fast cutting of multiple blocks over entire table area. Example: This machine has cut 1,800 ironing board pads per hour.





HEAVY DUTY ROLLER DIE CUTTER with VERTICAL DIE HANDLING DEVICE

Adaptable to Roll Goods and Sheet Goods. Concavity of side cuts and "stretch" of material which were problems with previous cutting methods, is reduced to a minimum with this machine using Vertical Die Handling attachment. Cuts polyether, latex foam, closed and open cell sponge, supported and unsupported vinyl fabrics, supported foam rubber, cork, curled hair, Fiberglas, Tufflex, rough cut vinyl floor tile, sole stock and uncured stocks.

OTHER FEMCO DIE CUTTING AND SPLITTING MACHINES FOR

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Conveyorized Slab Cutters—Vertical Side Trimmers—Deep Throat Vertical Saws—Cut-Off Saws—Horizontal Splitters (Laboratory Size)—Heavy Duty Splitters (for semi-rigid materials such as Styrofoam, polystyrene, etc.)—Automatic Roll Feed Roller Die Cutters—Standard Roller Die Cutters.

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Established 1917

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vides the corporation with a complete line of plastic, aluminum foil, and paper-foil laminated closures.

The manufacturing facilities of Basca will be moved to Chicago, Ill., and St. Louis, Mo., where they will be combined with the **Closure Div.**, and the **Johnston Foil Div.**, respectively.

Borden Chemical Co. has announced that new facilities for the production of polyvinyl acetate beads have gone on stream at its Illiopolis, Ill., plant, which also produces PVAc emulsions, PVC, and butadiene-styrene emulsions.

PVAc beads have found increasing use in hot-melt adhesives, printing inks, decorative coatings, lacquers, and can lining formulations.

National Starch Products, Inc. has put a new plant on stream at Slough, Bucks, England, for the polymerization of a wide range of polyvinyl acetate emulsions. The plant is operated by **National Adhesives, Ltd.**, a subsidiary.

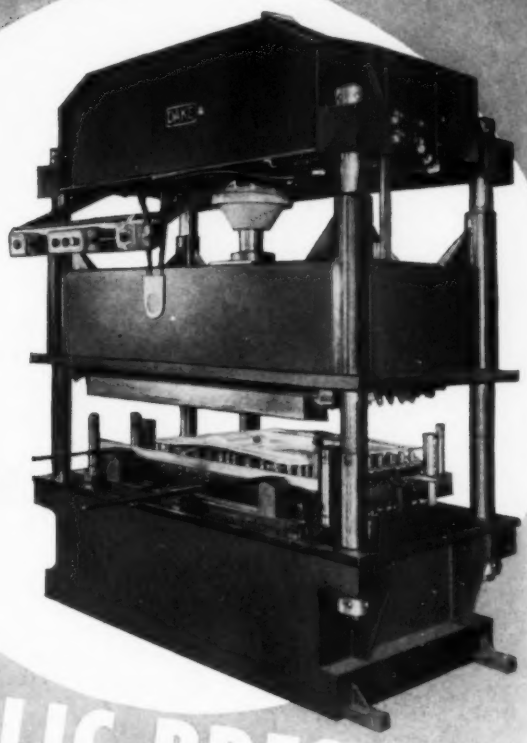
The new installation makes available a complete line of PVAc emulsions, and duplicates products which are marketed by the parent company in the U. S. and Canada.

Celanese Corp. of America and **Imperial Chemical Industries, Ltd.**, the largest manufacturing company in Great Britain, have formed **Fiber Industries, Inc.**, a jointly-owned subsidiary, to produce in the United States a polyester fiber of the same general chemical composition as Du Pont's Dacron (polyethylene terephthalate). The new fiber is tradenamed Teron.

Construction of the initial unit of the subsidiary's plant is slated to start immediately upon selection of the site; with work on the main plant scheduled to begin sometime in 1959. Eventual capacity is expected to be 40 million lb. a year.

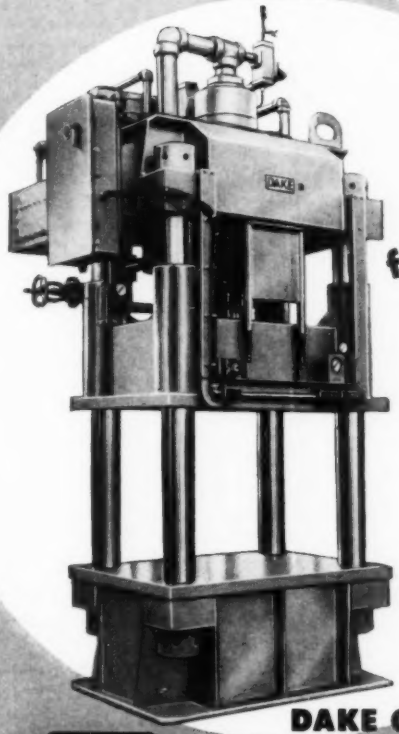
Celanese also plans to double the capacity of its acetic acid

available in standard and custom engineered models



for trimming and piercing vacuum-formed plastics

DAKE HYDRAULIC PRESSES



for molding reinforced plastics

Be a pacemaker in the fast-moving plastics industry with equipment designed to keep production geared to modern trends. Dake Hydraulic Presses speed output and reduce costs. They are job-engineered by men experienced in the plastics industry. These men are ready to help you meet special requirements as well as provide better equipment . . . both for compression molding of reinforced plastics as well as trimming and piercing vacuum-formed plastics. Standard models are electric-hydraulic in operation, with capacities ranging from 25 to 300 tons. They are adjustable for stroke, pressure, temperature and timing. Dual palm-operated controls are standard, providing safety in operation. Dake will gladly work with you in developing whatever special press equipment you need.

For descriptive literature on these presses, write for Bulletins 340 and 352.

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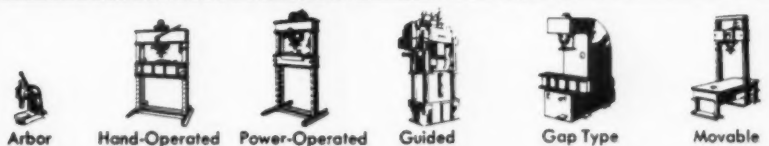
DAKE PRESSES



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Sheets .020 to .050, 36″x48″ only

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Choice of First Grade or S-Grade in clear or translucent white

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plant at Pampa, Texas, by late 1959. Added facilities will enable the plant to produce 240 million lb. a year, or 15% of the nation's total requirements for this chemical.

Acetic acid serves as a raw material in the manufacture of cellulose acetate, vinyl acetate, and as an intermediate for many other chemicals.

Reichhold Chemicals, Inc., White Plains, N. Y., plans to establish a joint affiliate with Hong Kong industrialists for the manufacture of the company's entire line of industrial synthetic resins. The new enterprise is to be known as **Reichhold Chemicals (Hong Kong) Ltd.**

Plans are under way to build a two story plant in Hong Kong, which is expected to be ready for production by the spring of 1959. The new facilities will include offices, laboratory, and tankage space.

The Flintkote Co., Los Angeles, Calif., has arranged to purchase all of the assets and the business of **Orangeburg Mfg. Co., Inc.**, Orangeburg, N. Y., manufacturer of pipe and fittings.

Orangeburg will operate as a division of Flintkote and its identity, management and plant facilities will be maintained. For the year ended Dec. 29, 1957, Orangeburg reported net sales of almost $12 million and net income of a little over $1 million.

Flintkote is a producer of containers, cartons, adhesives, and other industrial products, and of a broad line of building materials.

Diamond Alkali Co., Cleveland, Ohio, intends to build a multi-million dollar, campus-style research center a few miles south of Painesville, Ohio. Present plans call for construction to be carried out in stages.

The initial phase, on which engineering has already begun, will cost from $2 to $3 million and will comprise a multi-unit group of buildings for central re-

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- Air-cooled cylinders.
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- High speed, high horsepower, high pressure (10,000 psi working pressure).
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- Complete packages fully wired for low cost installation.

A full line of valves, pressure gauges, dies and other accessories are available.

MPM AIR-COOLED PLASTIC EXTRUDER
Model No. EF-250-20

MPM Extruders are available in screw sizes of 1" — 1½-2" — 2½" — 3½" — 4½" — 6" — 8" with cylinders of 13.1 — 16:1 — 20:1 — 24:1 — LE/D Ratio — with or without vents

MPM Model No.	ESF-100-12 EF-100-12	EF-250-20	EF-350-20
Screw Diameter	1"	2½"	3½"
Le/D Ratio	12:1	20:1	20:1
Heating Load—Watts	1800	12,750	25,000
Heating Zones	2	4	4
Gear Ratio (Standard)	20:1	23.8:1	24.9:1
Transmission HP at 75 RPM	.45	28	37
Type Gears	Worm	Herringbone	Herringbone
Thrust Bearing Capacity Dynamic Load Rating	11,750#	215,000#	400,000#
B-10 Life at 75 rpm	4,000 hrs. at 5,000 psi 32,000 hrs. at 2,500 psi	27,000 hrs. at 10,000 psi 216,000 hrs. at 5,000 psi	25,200 hrs. at 10,000 psi 201,600 hrs. at 5,000 psi
Motor HP	.5	15 - 25	25 - 30
Screw Speed (Standard)	8-80 rpm	7-85 rpm	7-85 rpm
Output per hour	6-12 lbs.	85-135 lbs.	200-250 lbs.
Cooling System—Cylinder	None	Air	Air
Cooling System—Hopper	Water	Water	Water

Note: B-10 Life —
See Anti-Friction Bearing Mfg. Assoc. Stds. Specifications for other size Extruders on request.

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SLIP-EZE
for Polyethylene

For the extrusion and molding of polyethylene, a lubricant desired to produce "slip" without tackiness or greasiness.

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for Vinyl

VYN-EZE, an anti-blocking agent imparts many desirable properties to vinyl film, sheeting and tubing, such as very good anti-tacking property and excellent clarity. VYN-EZE is approved by the Food and Drug Administration for use in materials in contact with food products.

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for Nylon
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A high quality anti-static agent which does not discolor or soil, STAT-EZE is the answer to the annoying problem caused by static accumulation on carpeting, particularly nylon and synthetic blends, as well as wool, particularly in dry weather.

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search and development. It will provide space for 60 laboratories, 22 offices, library, patent dept., and other supporting services.

Ferro Corp., Cleveland, Ohio, has appropriated $150,000 as the first phase of a long-range expansion program for the Color Div. of its **Ferro Enamels de Mexico, S.A.** subsidiary in Mexico City. The expansion is for color oxides for the plastics, enamel, and ceramic industries in Mexico, where Ferro has been producing colors since 1955.

Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio, is adding approximately 10,000 sq. ft. of manufacturing and production facilities to double the plant capacity of its **Mac-Erie Machine Div.** Space and equipment for repair and overhaul of injection machine heating cylinders of all makes and design are included in the expansion, which is adjacent to the present plant at 11th and Walnut Sts., Erie, Pa.

The Electric Storage Battery Co. has moved its 41-man basic and applied research team from its Philadelphia, Pa., plant to a new and separate research facility at 19 W. College Ave., Yardley, Pa.

The new center will permit further extension of the company's research in plastics, metallurgy, and other fields.

By-products of ESB Co. research are the development of plastics materials for synthetic kidneys, lungs, and other artificial organs, and work on a membrane that acts as a selective gate valve to sort contaminants from liquids.

Other divisions and subsidiaries of the company that will benefit from the new research center are: **Stokes Molded Products Div.**, Trenton, N. J., maker of molded plastics and hard rubber products; **Mayfair Molded Products Corp.**, Schiller Park, Ill., producer of plastics and molded

(*To page* 356)

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2 PROBLEMS
✓Quicker mold-cost amortization
✓Smaller parts inventories

Carry minimum inventories of custom-molded miniature plastics parts without excessive cost penalties.

Write off the cost of molds much more quickly because your original investment is much less.

Booker & Wallestad have developed unique processes for producing precision quality parts in any quantity, using any compound. There are very substantial savings in mold costs. Set-up time is saved. Production time is saved at every step, even when specifications are exacting.

These advantages make possible very short runs of controlled quality. They avoid inventory losses where model changes are frequent. Ask Booker & Wallestad to prove these claims on the basis of your requirements.

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For the full story on Chromalox Electric Strip Heaters, call your Chromalox Representative, or, write to the address below for free Bulletin F1566. 2655

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"Plastics 1959"

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Dusseldorf/Western Germany—
17-25 October 1959

Information in USA:

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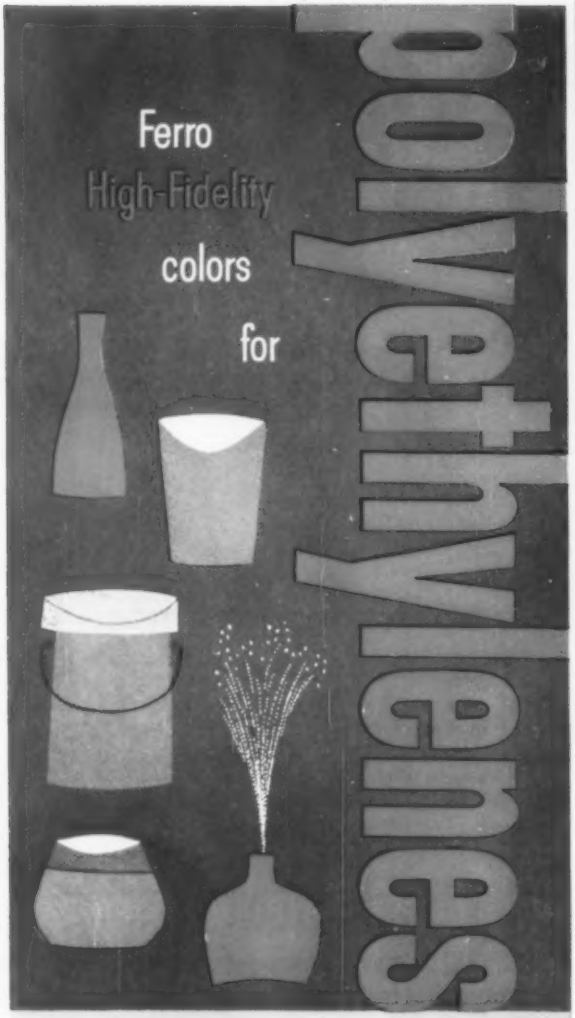

Ferro Colors now make it easy for you to color low-density or the new high-density polyethylenes in your own plant. You can save from $5.00 to $8.00 per 100 lbs. on resin costs. Ferro polyethylene pigments disperse quickly and are non bleeding. With simple equipment you can color mix only the amount of material needed for each order and eliminate scrap or waste. Write today for FREE booklet, *The Technique of Coloring Polyethylene!*

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Nacromer® gives

luxurious pearl-like lustre

to new Stopette squeeze bottle

Incorporated directly into the plastic, Nacromer synthetic pearl essence has transformed the usually dull, waxy appearance of the polyethylene into a bright, lustrous surface. Made by the Plax Corp., Bloomfield, Conn., for Helene Curtis Industries, Inc., the Stopette Squeeze Bottle is an excellent example of the new beauty Nacromer gives to plastics.

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Plastics Problem?

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EXAMPLE: *Where and how to use resins and molding compounds?*

1. See the section "Resins and Molding Compounds" for all the fundamentals. Also see the materials charts and supplier lists in the "Technical Data" section.
2. Then check the Advertisers' Index—on the first page of the Resins . . ." section—for suppliers' ads on resins, coatings, emulsions, etc.
3. Secure additional names and addresses of suppliers from extensive Buyers' Directory lists in the back of the book.
4. Consult the Alphabetic Index for detailed cross-referenced listings of subjects related to your particular inquiry.
5. For more help, turn to the "Free Product Literature" section, select pertinent booklets and send for them with the enclosed free post cards.

EXAMPLE: *How to color plastics?*

1. See the section "Chemicals for Plastics" for complete background.
2. Next, refer to the Advertisers' Index on the first page of the section for ads relating to your specific needs.
3. Check the Buyers' Directory for a detailed listing of suppliers of dyes, stabilizers, plasticizers, etc.
4. Consult the Alphabetic Index for detailed cross-referenced listings of subjects related to your particular inquiry.
5. For more help, turn to the "Free Product Literature" section, select pertinent booklets and send for them with the enclosed free post cards.

EXAMPLE: *How to design a product—then get it made?*

1. Get the basic facts in the section "Engineering and Methods".
2. Then for molder and special service advertisements, see the Advertisers' Index on the section's first page.
3. Next, examine the Buyers' Directory for additional names and addresses of molders, extruders and service organizations.
4. Consult the Alphabetic Index for detailed cross-referenced listings of subjects related to your particular inquiry.
5. For more help, turn to the "Free Product Literature" section, select pertinent booklets and send for them with the enclosed free post cards.

EXAMPLE: *Which machinery to buy?*

1. Turn to the section "Machinery and Equipment" for a complete picture of the factors involved.
2. Then see the Advertisers' Index on the first page of this section and select ads whose messages bear on your problem.
3. Get further information—names and addresses of machinery, machine tool and equipment manufacturers—in the time-saving Buyers' Directory.
4. Consult the Alphabetic Index for detailed cross-referenced listings of subjects related to your particular inquiry.
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The Encyclopedia is expressly designed to help you solve your problems. Reach for it next time you need help and see how valuable it can really be!

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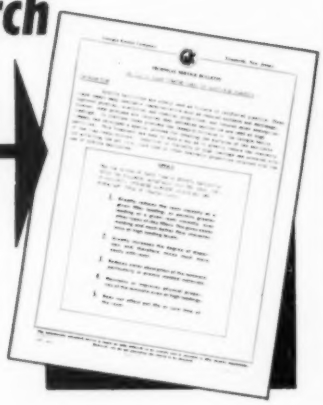
. . . for fast, accurate answers to plastics problems

From GK Research



. . . a new report on the use of

RESIN-TREATED CLAYS in Reinforced Plastics

Georgia Kaolin's latest technical bulletin, TSBT-84, details the advantages offered to manufacturers of reinforced plastics by GK's new type of kaolinite fillers . . . the REA series of RESIN-TREATED CLAYS . . . which have a profound effect upon the viscosity of resin clay mixtures. The viscosities of a typical polyester with various loadings of the new REA series of clays are shown below in Figures I, II and III. Also shown on these graphs are viscosities with the corresponding untreated Hydrite Kaolinites. In all cases the RESIN-TREATED CLAY, in comparison to untreated clay, greatly reduces the viscosity of the polyester at given filler loadings.

The reduced viscosity permits a considerable increase in the amount of filler which can be effectively incorporated into the final laminate and still be moldable. Typical physical properties of RESIN-TREATED CLAYS are shown in Table I.

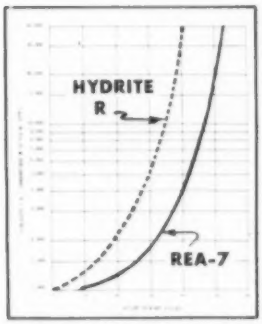


Figure I. Effect of RESIN-TREATED REA-7 on the viscosity of a polyester resin.

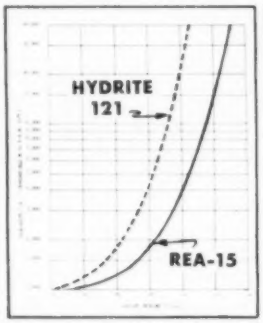


Figure II. Effect of RESIN-TREATED REA-15 on the viscosity of polyester resin.

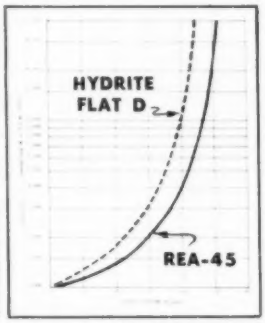


Figure III. Effect of RESIN-TREATED REA-45 on the viscosity of a polyester resin.

Table 1
Typical Physical Properties
RESIN-TREATED hydrated aluminum silicate pigments

	REA-7	REA-15	REA-45
Resin Viscosity* @ 40% filler in Polyester Resin	4000 cp	4000 cp	4500 cp
pH @ 20% Solids	6.5-7.5	6.5-7.5	6.5-7.5
Brightness (G.E. Meter) % of MgO	85.0-86.5	83.0-84.5	80.2-83.6
Screen Residue (325 mesh) (Max.)	0.02%	0.10%	0.15%
Moisture (Maximum)	1.0%	1.0%	1.0%
Average Particle Size (Microns)	0.77	1.5	4.5
Refractive Index	1.56	1.56	1.56
Specific Gravity	2.58	2.58	2.58

*Measured at 10 rpm on a Brookfield viscometer 25°C.

Based on GK's tests, the REA series of RESIN-TREATED CLAYS allows optimum filler loadings with such resins as polyesters, phenolics and alkyds.

We will be glad to send you a copy of Technical Service Bulletin TSBT-84, and free samples, upon request.

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The Plastiscope

soft rubber goods; **Jessall Plastics Div.**, Kensington, Conn., extruder of plastics rod and tubing; **Atlas Mineral Products Co.**, Mertztown, Pa., producing fabricated plastics equipment for industry, coatings, linings, etc.; **Willson Products Div.**, Reading, Pa., manufacturer of industrial safety equipment and sunglasses; and **Jordan Electric Products Div.**, Clinton, Mass., maker of battery testing equipment, and portable emergency lighting units.

Petroleum Chemicals, Inc. has announced that a plant, designed to produce 200 million lb. of ethylene annually, has been brought on stream at Lake Charles, La. The plant can be expanded to a 300 million lb. per year capacity when desired.

The ethylene will be sold to other chemical manufacturers for making polyethylene, ethylene oxide, and ethylene glycol antifreeze. The plant will also make propylene.

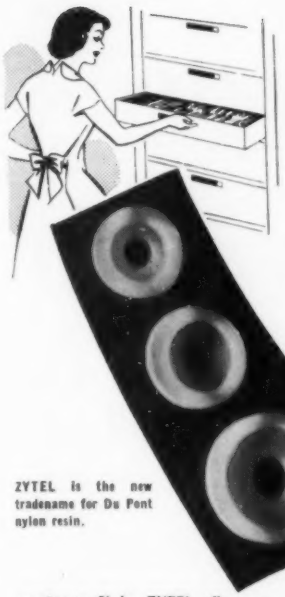
The first interstate pipeline for transporting ethylene connects the P.C.I. installation with plants of Du Pont and Spencer Chemical Co. at Orange, Texas. About half of the present plant capacity will be moved through this pipeline to these customers.

The company also plans to expand its research into the manufacture of new chemicals from petroleum, and development of new manufacturing projects for the company.

Rap-In-Wax Paper Co., Minneapolis, Minn., flexible packaging firm, acquired **U. S. Packaging Corp.**, Paterson, N. J., manufacturer of polyethylene-coated cellophane, polyethylene-coated Mylar, and other pouch materials.

A. R. Cozzolino, pres., and **G. C. Rickelmann,** VP and plant mgr., U. S. Packaging, will retain these offices.

Wasco Chemical Co., Cambridge, Mass., producer of plastics "Skydomes" and acrylic plastics, has acquired over 80% of the stock



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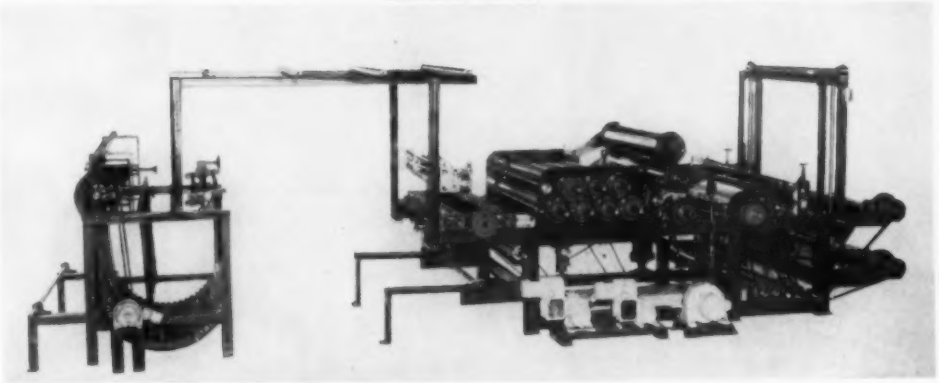

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For more details on this unit or on Liberty's complete range of economical, easy-to-operate processing equipment—including polishing units, one and two-color presses, coating equipment, and inspection units—write for Liberty's free catalog.

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Sole Distributor in the United States

The Plastiscope

of **Tru-Scale, Inc.**, Wichita, Kans., producer of resin-impregnated fibrous glass and reinforced plastics products. The acquisition is part of a planned expansion program to accelerate Wasco's development program of plastics materials and products for the building industry.

General Mills has announced that it will start production of epoxidized soybean oil in new facilities at Minneapolis, Minn.

Epoxidized soybean oil is used extensively as a plasticizing stabilizer for polyvinyl chloride resings, and General Mills claims the basic patents for this use.

Micron Specialties Co., Inc., completed its new plant at 4551 Diversey Ave., Chicago 39, Ill. The new facility is devoted to superfinishing and polishing of plastics molds and dies.

Meetings

Plastics groups

November 17-21: The Society of the Plastics Industry, Inc., 8th National Plastics Exposition, International Amphitheatre, Chicago, Ill.

November 17-21: The Society of the Plastics Industry, Inc., S.P.I. Annual National Conference, Morrison Hotel, Chicago, Ill.

January 7, 1959: Society of Plastics Engineers, Inc., Western New England Section, Bradley Field, Terrace Dining Room, Windsor Locks, Conn. Subjects: "Polystyrene in Lighting," "Mold polishing."

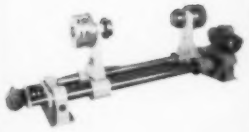
Other meetings

November 25: Manufacturing Chemists' Association, Inc., 8th Semi-Annual Meeting and Winter Conference, Hotel Statler, New York, N. Y.

January 12-16, 1959: National Housewares Manufacturers Association, 30th NHMA National Housewares Exhibit, Navy Pier and Drill Hall, Chicago, Ill.

Dilts UNWINDS

SINGLE POSITION



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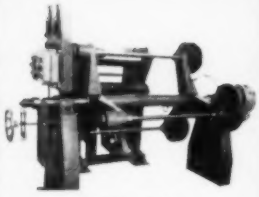

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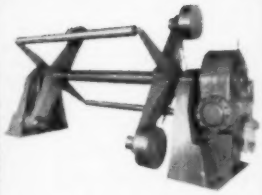

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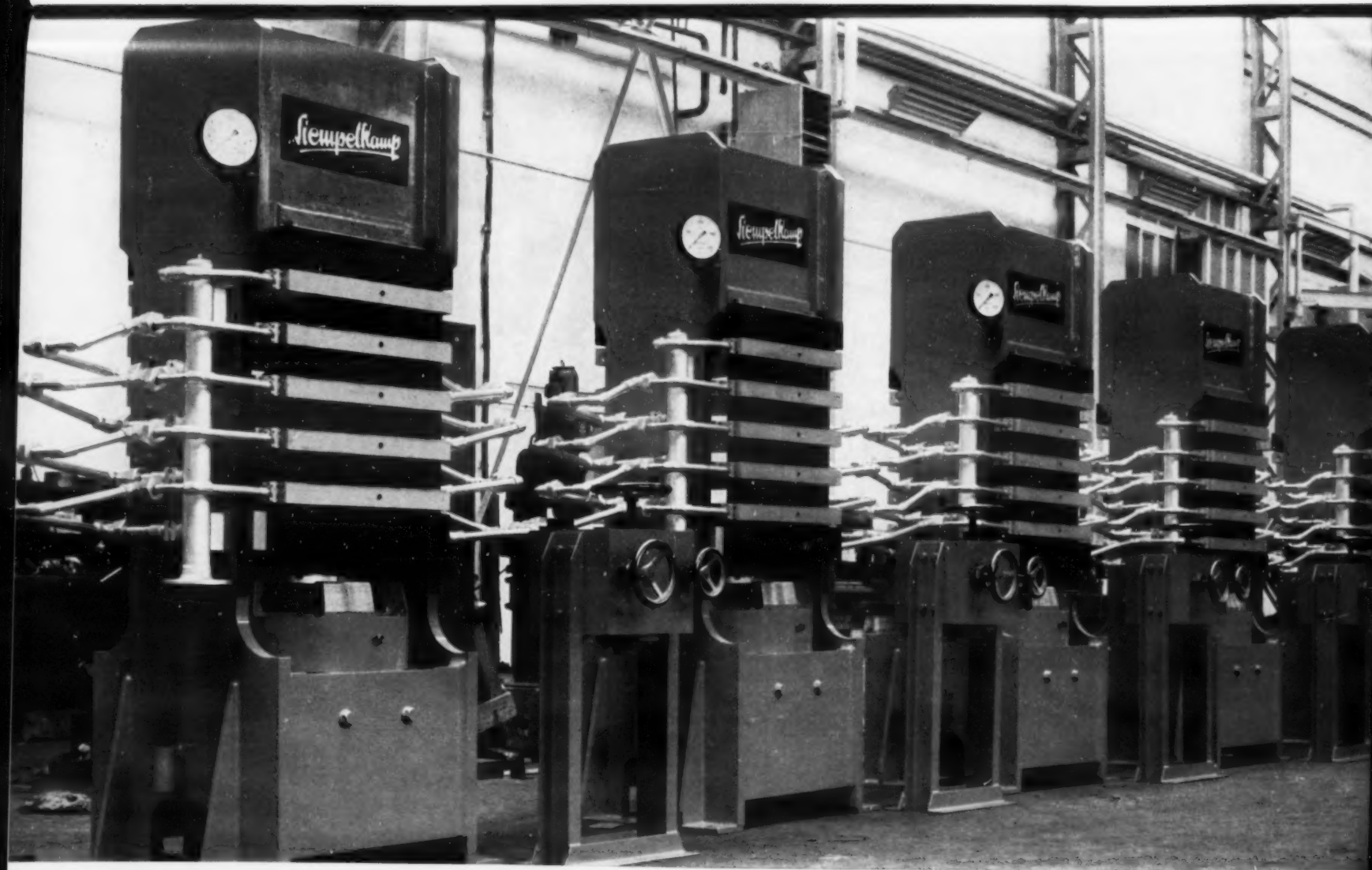

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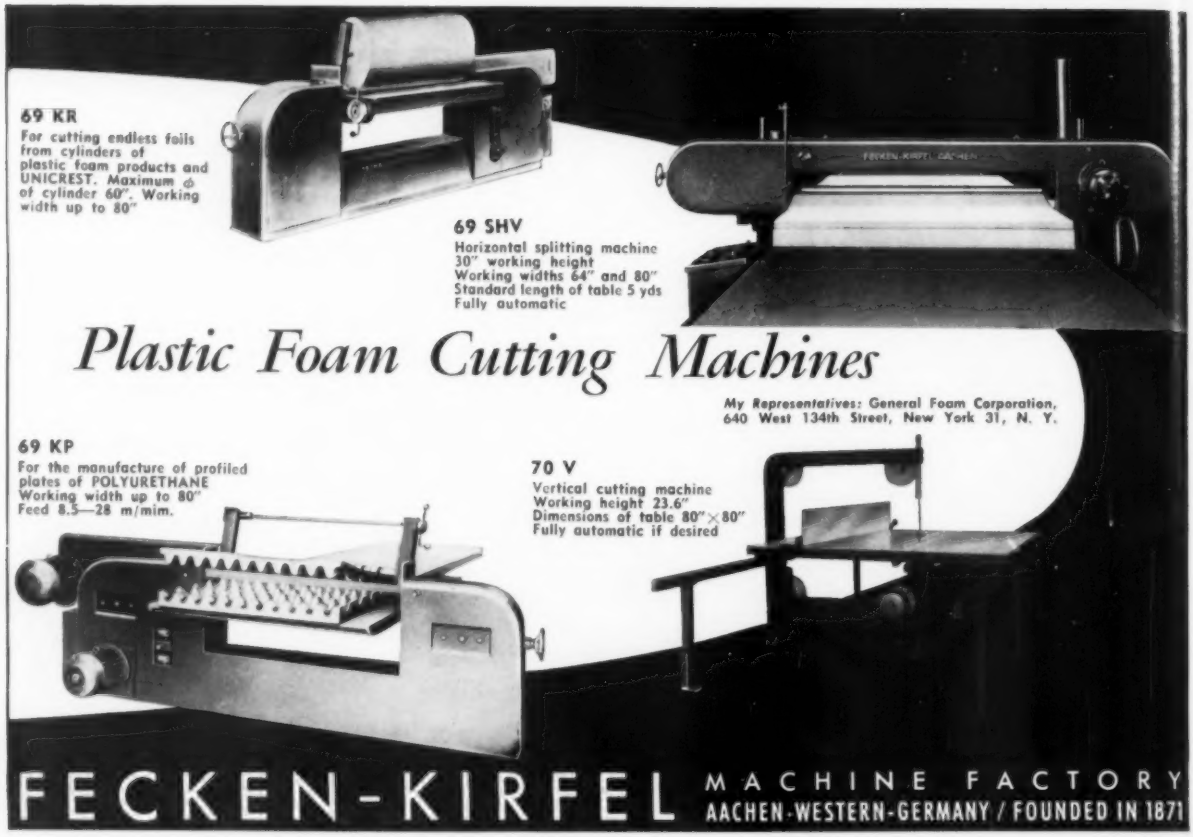
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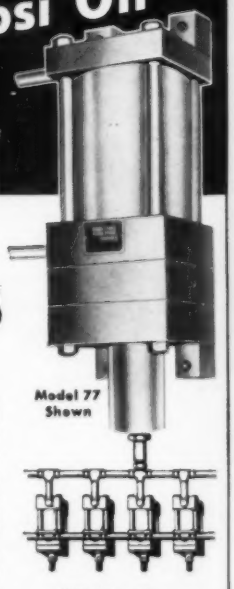

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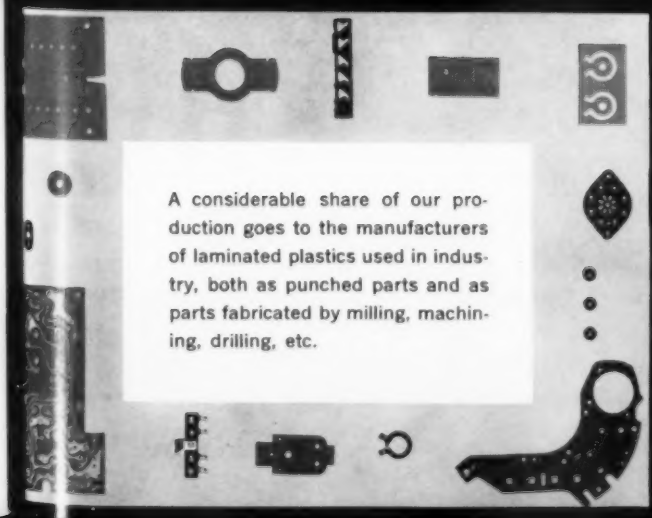

A considerable share of our production goes to the manufacturers of laminated plastics used in industry, both as punched parts and as parts fabricated by milling, machining, drilling, etc.

That's right. We make the base or surface paper for both decorative and industrial laminated plastics—the only layer which the user of the finished laminate sees. This supplies the color of the finished product, which might be white or any color or hue in the spectrum.

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Companies . . . People

The Dow Chemical Co.: Dr. William H. Schuette elected a company VP. He will continue as gen. mgr. of **Midland Div. G. J. Williams** named

W. Schuette G. Williams D. Gibb

sales mgr. of Plastics Dept., in succession to **Donald L. Gibb**, who has retired, but will assume new duties as a special consultant to the company's sales dept.

Union Carbide Corp.—Union Carbide Chemicals Corp.: Melvel W. Duncan, previously Kansas City dist. mgr., now dist. mgr. for St. Louis. He is succeeded by **John J. Berry**, formerly Chicago dist. mgr. **Hugh E. Klein** named dist. mgr. for Chicago. **Dr. Malcolm B. VerNooy** replaces Mr. Klein as product mgr. in the New Chemicals group.

Bakelite Co.: Lewis D. Harris, Jr. named tech. sales rep. for film and sheeting materials, operating from Clifton, N. J. **Jacque R. Smith** appointed tech. sales rep. for molding materials with headquarters in Hartford, Conn.

Air Reduction Co., Inc., Air Reduction Chemical Co.: Gordon E. Cole named mgr. of gen. sales. **Charles O. Herman** appointed mgr. of tech. sales.

Olin Mathieson Chemical Corp., Packaging Div.: P. C. Brownell and **M. L. Herzog** appointed corporate VPs. They will continue to manage the company's Ecusta paper and film operations respectively, and have headquarters at Pisgah Forest, N. C. Mr. Herzog also named research dir.

W. R. Grace & Co.—Cryovac Div.: William H. Squire named to newly created post of sales development mgr. **Richard H. Burnham** succeeds Mr. Squire as sales promotion mgr. Both will locate at Eastern Div. headquarters in Simpsonville, S. C.

St. Regis Paper Co., Panelyte Div., decentralized its administrative operations from New York to Trenton, N. J.; Kalamazoo, Mich.; Yonkers, N. Y.

The company manufactures industrial laminates at its Trenton plant and decorative laminates in Kalamazoo.

P. P. Ryan, asst. VP and gen. sales mgr. of Panelyte Div., **W. E. Deasy**, gen. mgr.—manufacturing, and **John M. Zeier**, sales mgr.—industrial laminates, will be located in Trenton.

C. L. Walters, decorative sales mgr., **W. R. Sievert**, headquarters sales mgr., **E. J. Carow**, Panelyte distributor sales mgr., and **Keith V. Swonsen**, direct sales mgr., are located in Kalamazoo.

General Electric Co., Chemical & Metallurgical Div.: Dr. A. Eugene Schubert named gen. mgr. of Chemical Materials Dept., succeeding **Sam L. Brous**, who was named marketing mgr. **James W. Raynolds**, previous marketing mgr., who is scheduled to retire in February 1959, assigned as consultant to gen. mgr. of the div.

These appointments were made in anticipation of the transfer of the Lexan polycarbonate resin project from the development to the commercial stage. The actual move,

A. E. Schubert S. L. Brous

which is planned for the end of the year, will result in the Chemical Materials Dept., at Pittsfield, Mass., having development, production, and marketing responsibility for the new material, in addition to its present line of phenolic resins and molding powders, Methylon coating resins, and electrically fused magnesium oxide.

Dr. Schubert will continue to head the Chemical Development Dept. until the transfer is effected.

Allied Chemical Corp.—Plastics & Coal Chemicals Div.: James E. Shand appointed mgr., chemical sales, and **John C. Esher**, asst. mgr.

Solvay Process Div.: Dr. Robert H. Reed appointed dir. of research; **Dr. Herbert C. Wohlers** becomes asst. dir.; and **Dr. Arlie P. Julien** named chief of application research. The three newly created posts are in Solvay's research dept., Syracuse, N. Y.

Chemical Marketing & Mfg. Corp. is the new corporate name of **Chemical Marketing Corp.**, previously located at 549 E. Illinois St.; now has offices and manufacturing facilities established at 66 W. Carroll St., Chicago 10, Ill.

The company will now have three divisions—one to fabricate and manufacture various items in the foamed plastics field and packaging industry; another to develop and market foamed plastics consumer products; and a third to specialize in the sale of chemical protective coatings to the chemical and food processing industries. The last will act as distributor for **Valdura Div.** of **American-Marietta Co.**, producer of Val-Chem epoxy, vinyl, urethane, phenolics, and chorinated rubber coatings.

W. W. Wibel, sales mgr., will coordinate marketing activities of all three divisions.

B. F. Goodrich Chemical Co.—B. F. Goodrich Chemical Co.: Harry B. Warner named VP—marketing, in succession to **James C. Richards, Jr.**, recently named VP—sales, **B. F. Goodrich Industrial Products Co.**

H. B. Warner

B. F. Goodrich Canada, Ltd.: Ira G. Needles, previously pres., named chrmn. of the board. **Robert V. Yohe**, formerly VP—sales, B. F. Goodrich Industrial Products Co., elected pres. and chief exec. officer of the Canadian company.

Harwick Standard Chemical Co.: D. F. Behney promoted from VP—sales to exec. VP. **William L. Lasser**, formerly pur. agt. and asst. warehouse supt., is now VP—operations. **Harvey G. Greer**, previously tech. dir., named to newly-created post of VP in charge of tech. development. **C. R. Simpson** appointed tech. sales rep.

Flexonics Corp., Maywood, Ill., opened offices in Detroit, Mich. to house headquarters of its Automotive Div., under gen. mgr. **J. W. Wood**; and its central regional sales office headed by regional mgr. **R. G. Arnold.**

The company will cease manufacturing operations at its Inkster, Mich. div. Production of plastics and synthetic hose products will be transferred from Inkster to other Flexonics plants.

Gries Reproducer Corp.: Willis M. Lester, Nyack, N. Y., appointed exclusive sales agent to resale outlets in southeastern N. Y. state.

Warren G. Snyder, head of **M. C. Snyder Co.**, Lansing, Mich., will handle GRC industrial products and services for the original equipment market in parts of Michigan.

Commercial Plastics & Supply Corp., 630 Broadway, New York, N. Y., opened a regional sales and service office and warehouse at 548 Rising Sun Ave., Philadelphia, Pa. **Donald E. Moehler** is gen. mgr.

Midland-Ross Corp., Cleveland, Ohio: **E. F. March**, formerly treas. of American-Marietta Co., appointed to newly created position of VP—finance. **C. W. Elliott**, VP in charge of industrial and public relations, named VP—admin. and given additional executive responsibilities over

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PLASTIC MOLDING PRESSES

This 300 ton molding press, built for a manufacturer of reinforced plastic products, has three closing and two opening speeds. The intermediate and final closing, as well as initial opening speeds are adjustable from the control panel on the press.

While many of the features furnished are not essential for normal molding operations, they were included because this press is used primarily in experimental molding to establish optimum procedures for later production molding operations.

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PENNSYLVANIA, Pittsburgh: Frank Ryman's Sons
Wynnewood (Phila.): Edw. A. Lynch Machinery Co.
WASHINGTON, Seattle: Perine Machinery and Supply Co.
WISCONSIN, Milwaukee: Pagel Machinery Co.
NEW YORK, Buffalo: H. D. Thweatt Co.

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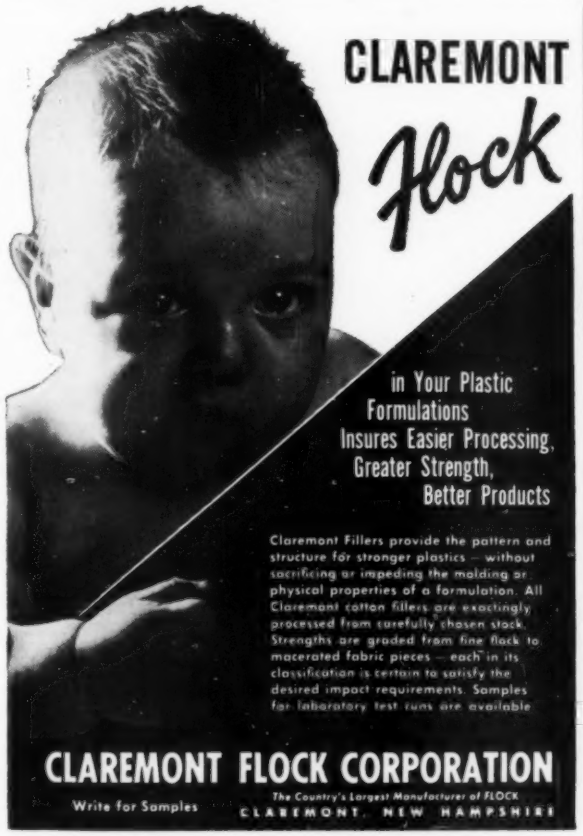

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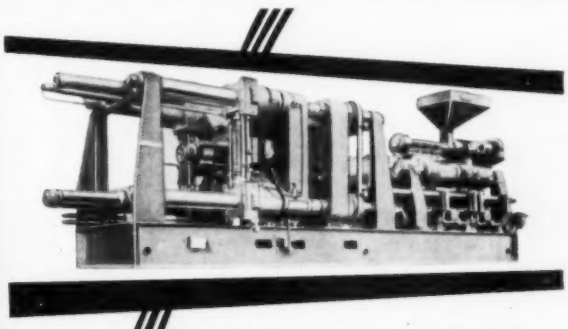

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Companies... People

the **Ross Engineering Div., Ross Engineering of Canada, Ltd.,** and the **John Waldron Corp. Saxton W. Fletcher,** Corporate VP in charge of the Ross and Waldron operations, elected vice chrmn. of the board.

William Ibsen named asst. to sales mgr. for the structural resins dept. of **Ciba Co. Inc.,** Plastics Div., Kimberton, Pa.

Dr. Victor L. Erlich elected VP and dir. of basic research and development of **Reeves Brothers, Inc.,** 1071 Ave. of the Americas, New York 18, N.Y., producer of polyolefin monofilaments.

Frank W. Reinhart, chief, plastics section, **National Bureau of Standards,** appointed a member of the administrative committee on standards of the **American Society for Testing Materials,** and a member of the materials and testing standards board of the **American Standards Association.**

Wallace P. Dunlap, Jr. appointed prod. supt. of **Mobay Chemical Company's** New Martinsville, W. Va. plant.

E. F. Houghton & Co.: David J. Richards retired as VP—sales and dir. **Frank Ross** named VP—sales; and **Charles R. Schmitt** now asst. VP—sales. The company manufactures mold release agents, antistatic agents, lubricants, and other processing products.

Russell M. Fellows, formerly VP and treas. of **The Fellows Gear Shaper Co.,** Springfield, Vt., manufacturer of injection molding equipment, elected chrmn. of the board.

Charles Lahr, Jr. named div. dir. of **Vinfloat Industries Div., Alberhill Corp.,** Los Angeles, Calif., manufacturer of vinyl toys.

Alfred Schechter resigned as pres. of **Chester Packaging Products Div., St. Regis Paper Co.,** in order to follow broader interests in the field of packaging in plastics. Chester, founded by Mr. Schechter in 1946, was merged with St. Regis Paper Co. in 1956.

Owens-Corning Fiberglas Corp. named a distributor of reinforced plastics Permadrain gutter and downspout systems, manufactured by **Permanent Products, Inc.,** St. Paul, Minn.

Print-A-Tube Co., 114 Essex St., Rochelle Park, N. J.: **Alexander B. Beal,** formerly prod. mgr. of printing dept., promoted to VP—production, replacing **Richard J. Dwyer;**

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METASAP VINYL STABILIZERS
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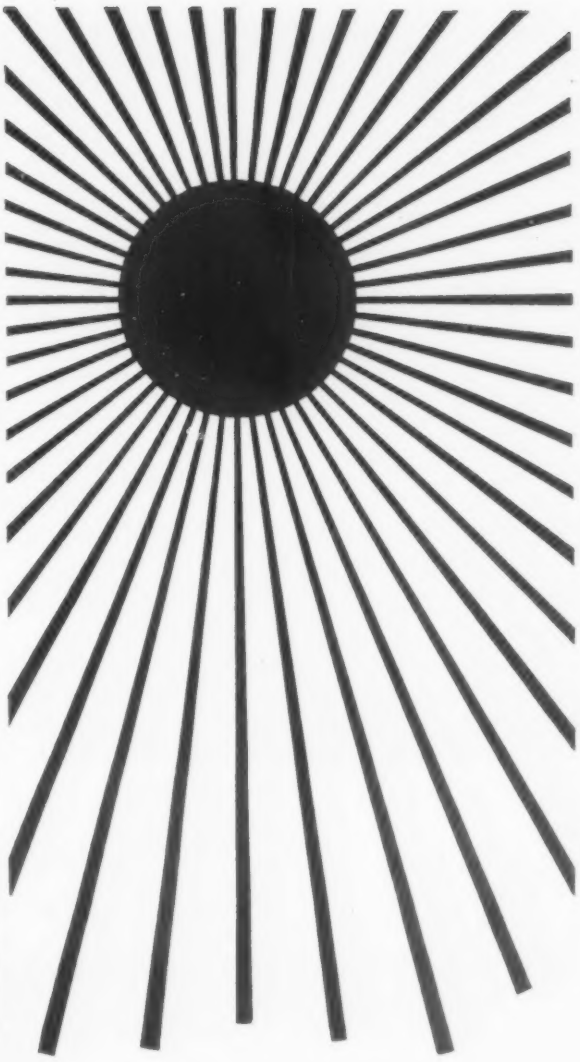

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The expertly crafted enclosure tells you — here's quality. Operating convenience is immediately apparent in the eye-level grouping of controls. Protective interlocks are representative of many safety features. And behind the easy-access doors you'll find engineering, workmanship and components that mean standout performance and dependability. For example, the water-cooled oscillator is built for 5000 hours of service. The heavy-duty plate transformer has a large reserve capacity. Clean wiring arrangements, bakelite standoff, ceramic coils, sturdy relays are just a few more reasons why the Allis-Chalmers dielectric heater is preferred equipment.

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When you specifiy Allis-Chalmers, skilled electronic engineers help plan the most efficient use of your dielectric heating. The modern A-C laboratory is at your disposal for material testing. Services include the design of work-handling equipment. Installation is supervised by a trained field engineer. Periodic checkup and emergency maintenance service are also supplied by Allis-Chalmers regional offices conveniently located near you.

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A-5774

Companies . . . People

Justin Field, previously gen. mgr. of the company's subsidiary, **Skin-Pak Machinery Co., Inc.,** named asst. to pres. of the parent company. **Ralph I. Perault** succeeds Mr. Field at Skin-Pak. **R. T. Lanigan** appointed southeastern sales rep.

Revell, Inc.: B. G. Ramos promoted from dir. of international operations to exec. VP. He is succeeded by **Paul Escoe,** who will also continue as Eastern mgr. at the company's S. Plainfield, N. J. plant.

Donald T. Wynne, Jr., formerly asst. to the VP—operations of International Molded Plastics, Inc., Cleveland, Ohio, named asst. mgr., Plastics Div., **Vlchek Tool Co.,** Cleveland.

Catalin Corp. of America, established Midwest regional sales offices at the LaSalle-Wacker Bldg., 221 N. LaSalle St., Chicago, Ill.

William H. Brown, advertising mgr. of **National Vulcanized Fibre Co.,** named mgr. of the company's newly-formed Marketing Dept.

Emery Industries, Inc.—Organic Chemical Sales Dept.: Robert S. Haley appointed to the New York, N. Y., offices; **J. Warren Sackett,** the Cleveland, Ohio, office; **Walter R. Paris,** the Lowell, Mass., office; and **Robert H. Endres** assigned to a newly-created territory with headquarters in Pittsburgh, Pa.

John E. Holt resigned as pres. of **The Danielson Mfg. Co.,** a subsidiary of **Nicholson File Co.,** Danielson, Conn.

Alan Graham appointed asst. to the gen. mgr. of **Clad-Rex Corp.,** subsidiary of **Simoniz Co.,** Chicago, Ill., producer of vinyl-metal laminates.

Arnkurt Associate Engineers moved from 31 E. 27th St., to 210 W. 29th St., New York 1, N. Y.

Nicholas T. Baldanza, formerly chief engineer for Curtiss-Wright, Plastics Div., Carlstadt, N. J., named asst. to the pres.

Arnkurt designs plastics or die casting molds, does product designs, makes models and prototypes.

Acme Machinery & Mfg. Co., Inc., 20 S. Broadway, Yonkers, N.Y., opened a sales office at 5222 W. North Ave., Chicago, Ill., **John Aquino** is dist. mgr. The company manufactures extruders, grinders, laminating and other machinery for the plastics industry and handles used equipment.

Borg-Warner Corp., Marbon Chemical Div: D. M. Pratt named sales mgr.—resins and adhesives. **William**

(*To page* 371)

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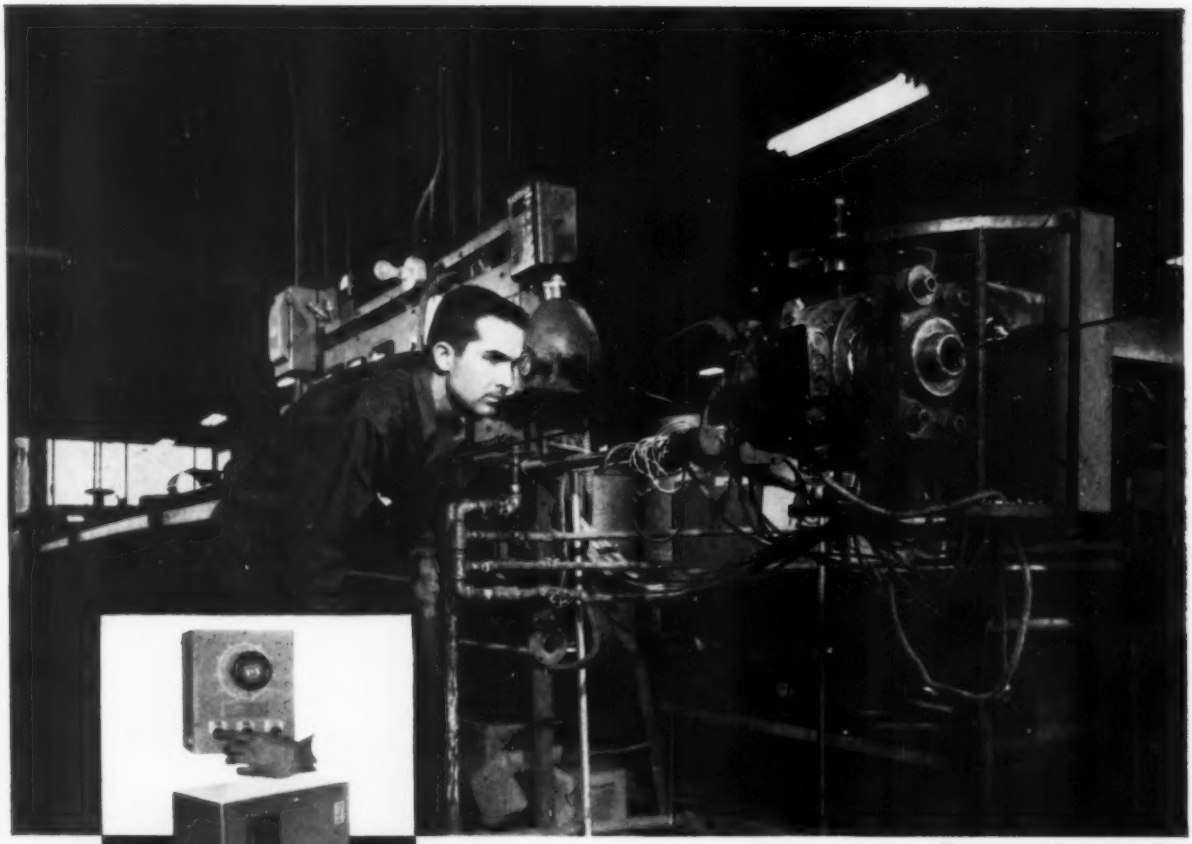

Photo courtesy Radix Wire Co.

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The productivity of an extruder depends upon how many shapes and forms it can turn out, and how many types of materials it will extrude. A Reliance Variable Speed Drive gives you more flexibility and puts maximum productivity into your extruder.

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And our modern injection molding shop—run by technicians raised in a Yankee tradition demanding perfection — assures your product uniform high *quality* at reasonable cost.

We look forward to hearing from you.

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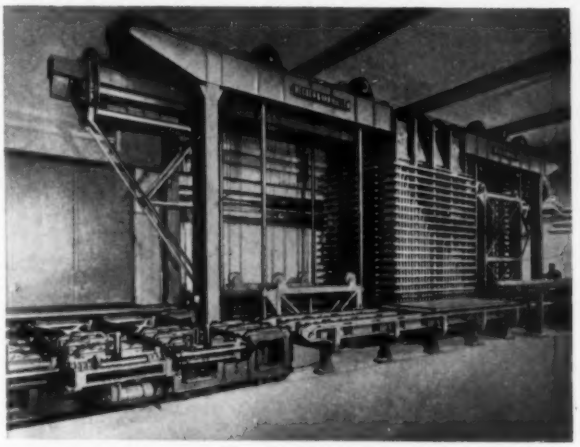

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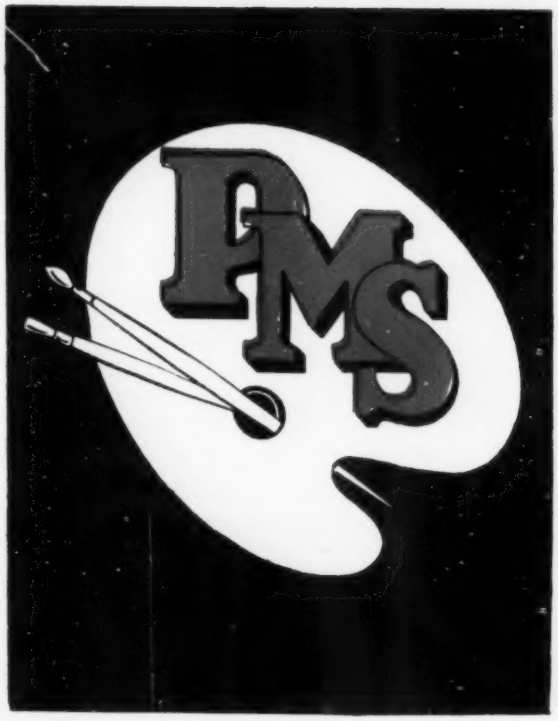

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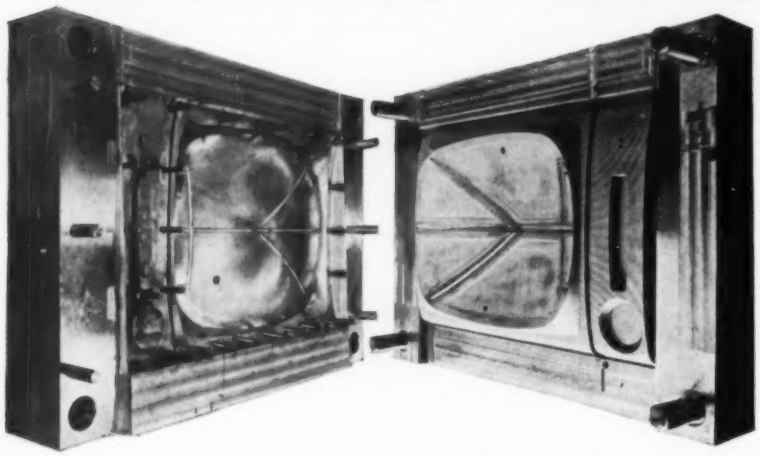

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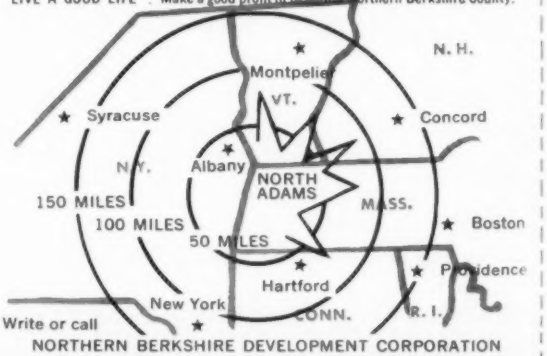

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Companies... People

A. Suiter, previously with Panelyte Div. of St. Regis Paper Co., appointed sales mgr.—Cycolac plastic. Both will headquarter at Marbon's Washington, W. Va., facilities.

Robert J. Jacobs, gen. mgr. of **Dilts Div., The Black-Clawson Co.**, named VP. Dilts produces converting equipment for the plastics, paper, and paperboard industries.

Russell S. Kribs, formerly VP and dir. of sales, named to newly created post of VP—marketing of **Tel-A-Sign, Inc.**, Chicago, Ill., manufacturer of illuminated plastics advertising signs.

Peter N. Triano named asst. sales mgr. of **Interplastics Corp.**, 120 E. 56th St., New York 22, N. Y., suppliers of polyethylene, polystyrene, nylon, and other plastics raw material.

Dr. Alex Sacher, formerly tech. dir. of Standard Insulation Co., E. Rutherford, N. J., appointed to newly created post of VP—commercial development of **Hudson Pulp & Paper Corp.**, New York, N. Y.

Outlook Sales, 6 Outlook Rd., Wakefield, Mass., a newly-formed organization headed by **John L. Patch**, formerly retail sales mgr. of **General Tire's Bolta Products Div.**, appointed manufacturer's rep. for Boltaflex yard goods and other plastics specialty products in the retail field.

Space Engineering, 39 S. Euclid Ave., Pasadena, Calif., will represent **Rogers Corp.**, Rogers, Conn., in California and Arizona. Rogers manufactures printed circuits, reinforced Teflon products, and other high-temperature items.

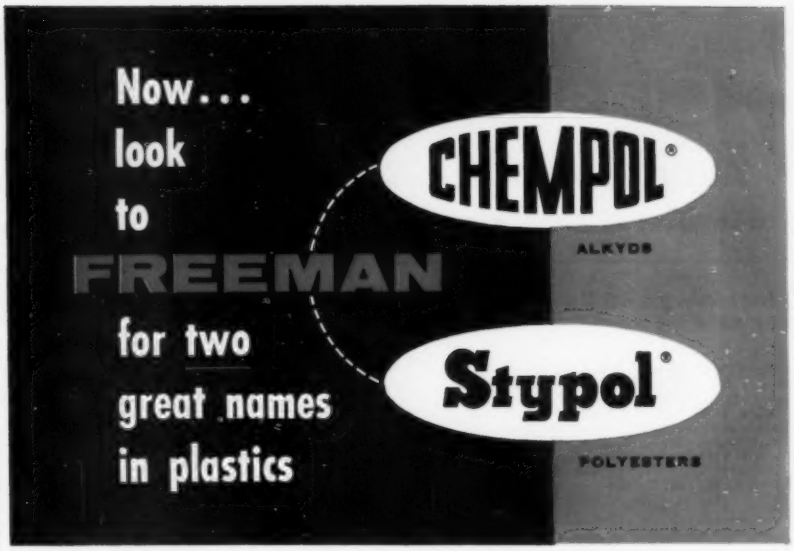
Gordon Research Conferences: Dr. John Ridgway Bowman of Northwestern University named chrmn.-elect of the Board of Trustees, succeeding **Dr. George B. Brown**, who became chrmn.

Dr. R. W. Cains, dir. of research, **Hercules Powder Co.**, elected a member of the board, and will serve for a three-year term.

Advance Molded Plastic Corp., injection, compression, and transfer custom molder, moved to 2601 N. Crawford Ave., Chicago, Ill.

Correction

"Chemie Wirtschaft in Zahlen." The second part of this book contains tables on production, export, and import of chemicals of the major producing countries throughout the world, not only of Europe. (M. PL., Books & Booklets, Oct. 1958, p. 164.)



Freeman Chemical Corporation, a subsidiary of H. H. Robertson Company, is pleased to announce an important expansion in

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In addition to its plant in Saukville, Wisconsin, Freeman now operates the former Robertson Stypol polyester resin plant at Ambridge, Pennsylvania. Stypol resins—along with the Chempol line of alkyd, urethane and foundry resins, emulsion vehicles and adhesives—will be manufactured at both locations. Freeman Chemical will also market bituminous compounds and copper powders made by Robertson at Ambridge. Freeman Chemical Corporation general offices will remain at Port Washington, Wisconsin.

We at Freeman welcome this opportunity to provide a more diversified group of products, an increased production capacity, added convenience of shipping points and a greatly expanded sales and technical advisory staff to serve you—the members of America's most progressive industry—plastics.

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FOR SALE PLASTIC MOLDING MACHINES: 1—12 oz. Watson Stillman; 1—8 oz. Reed Prentice; 1—4 oz. Reed Prentice. Very low price. Equipment Liquidation Co., 415 Third Avenue, Brooklyn 15, N. Y.

FOR SALE: The following machines for sale at low prices—1—16 ounce Lester Injection Molding Machine. 1946, good operation condition, extra 12 ounce cylinder. 1—16 ounce Watson-Stillman injection molding machine, 1946, good operation condition. 1—3 ounce Fellows injection molding machine Model 1B-3-15, Automatic 1952, excellent condition. 1—8 ounce Fellows injection molding machine, Model 15C-8, Automatic, 1951, excellent condition. 1—48 ounce Watson-Stillman injection molding machine, Model 48E-1000, 1953, includes weigh feeder, excellent conditon. 1—Stokes 48 inch Vacuum Metallizer, 1954, excellent condition. All machines available for immediate delivery. Zimmerman Machinery Company, 46 Easton Road, Westport, Conn. Telephone. CApital 7-0472.

FOR SALE: 3—200 Ton Stokes Semi-Auto Presses, 1—150 Ton Stokes Semi-Auto Press 1—150 Ton Stokes Fully Auto Press. Gas Fired Boilers—2, 5, 7½ & 10 HP. Preform Presses—RB-1, RB-3, Model T. Stokes. Misc. fancy & staple button dies. Reply Box 5009, Modern Plastics.

INJECTION MOLD MACHINE FOR SALE: 2½ ounce Van Dorn injection mold machine, fully automatic, model 250, slightly used. 3 ounce 1958, Clifton injection mold machine platen size 13x13 completely automatic, slightly used. Write, New York Doll Shoe Co. Inc., 360 Furman St., Bklyn, 1, N.Y., ULster 5-7020.

FOR SALE: 300-H 12 oz. HPM molding machine, new when bought, operated 4484 hours. Tilton & Cook Co., 38 Spruce St., Leominster, Mass.

FOR SALE: Miller 6 spindle rotational plastisol casting machine—Practically new—Never in production—Reasonable Price. B. L. Custer Co., Marietta, Ga.

FOR SALE: 3-750 gal. stainless reactors. 11-Baker-Perkins 200 gal. sigma blade mixers. Pfaudler glass-lined reactors: 750, 500, 300, 100, 30 gal. Farrel-Birmingham 1500 HP horiz. reducer, 5:1 ratio. Ribbon mixers 336, 200, 75 cu. ft. Stokes tablet or preform presses, rotary cutters, mills, etc. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: H.P.M. Rubber Injection molders, 21½"x28" mold space, steam heated platens. Watson-Stillman 300 ton semi-automatic compression molding press (1947) self-contained mold size 34"x27". Watson-Stillman 250 ton 28"x24". Watson-Stillman 140 ton 22"x16". Waterbury Farrel 85 ton 20"x24". W.F. 63 ton 15"x15". Laboratory presses —15 ton 10"x8" and 10 ton 6"x6" platens. (2) 8 ounce Reed Prentice injection molding machines and (1) 8 ounce Lester Phoenix (late) with nylon attachment. Scrap cutters, valves, accumulators. Hydraulic Presses—all sizes. Aaron Machinery Co. Inc., 45 Crosby St., New York, N.Y. Tel.: WAlker 5-8300.

FOR SALE: 1000 ton and 2000 ton hydraulic presses—1 oz. model H-200 Van Dorn injection machine—3 oz. Fellows, 8 and 12 oz. Lesters, 50 oz. Impco,—400 ton 36"x36" vertical presses—No. ½ and 1½ Ball and Jewell grinders—Carver laboratory presses and others to 75 ton—6"x13" laboratory mills—Plastic Machinery Exchange, 426 Essex Avenue, Boonton, N.J., phone DE 4-1615—Cable address Plasmex-Boonton.

FOR SALE: Late model L-2-8 Lester Injection molding machine. Like new, can be seen in operation in New York area. Reply Box 5000, Modern Plastics.

FOR SALE: 1 Baker Perkins 15USE, 100 gal. all stainless double arm Vacuum mixer; 1—Baker Perkins size 15VUUM, 100 gal. double arm mixer, 100 HP motor; 1—Baker Perkins size JNM 100 gal. double arm mixer; 6—Day 250 and 100 gal. double arm mixers; 1—Ball & Jewell #1 Rotary Cutter; 2—Two Roll Mills 6" x 12"; 6—Stokes model DD2, DS3, D3 and B2 Rotary Preform presses; 4—Stokes model "R" single punch Preform presses; Also: Sifters, Banbury mixers, Powder mixers, etc., partial listing; write for details; we purchase your surplus equipment; Brill Equipment Co., 2407 Third Ave., New York 51, N. Y.

FOR SALE: (6) 100 ton, 10" ram, 10" stroke @ $1250; (7) 200 ton, 9" stroke, 14" ram, 36x36, @ $2160; (6) 200 ton, 9" stroke, 15" ram, 30x30 @ $1850; (1) ton complete, 18x18 @ $1850; (1) 200 ton 16" ram 30x30 @ $2460; (2) 200 ton 16" ram, 42x42 @ $2850; (1) 200 ton, 15" ram, 42x42 @ $2600; (3) 250 ton (2) 12" ram, 30x60 rebuilt @ $3675. Hydraulic Sal-Press Co., Inc., 386-90 Warren Street, Bklyn., N.Y.

FOR SALE: Baldwin-Southwark 200 ton semi-automatic transfer molding press. 2500 ton downstroke 54" 102". French Oil 250 ton 38"x28". Elmes 200 28"x26". 200 ton hobbing press. 200 ton 16" record presses. D & B 140 ton 36"x36". French Oil 120 ton self-contained. W. S. 120 ton 24"x24". Hydraulic pumps and accumulators. Van Dorn 1 and 2 ounce injection machines. Lester 16 oz. complete. Other sizes to 100 oz. Baker-Perkins and Day jacketed mixers. Plastic cutters. Oxford 57" slitter. Seco 6"x13" and 8"x16" mills and calenders. Adamson 6" rubber extruder. Oil and Elect. Plastic extruders, lab to 6". Single & Rotary preform press ½" to 4". Partial listing. We buy your surplus machinery. Stein Equipment Co., 107—8th St., Brooklyn 15, N.Y.

GOOD EQUIPMENT: At the right price. Falcon ribbon blenders in steel or stainless; National Erie Extruder 6"x66", rotary cutters by Ball & Jewell, Sprout-Waldron, Abbe; Baker Perkins heavy duty dbl. arm mixers, 100, 200, 300 gal; F-B Plastic or Rubber Mills; 30" late style Blaw Knox S/S Resin Kettle 7'6"/7'6". Jktd. Agtd.: Sturtevant 300 cu. ft. Batch Mixer; Stokes and Colton Rotary and Single Pre-form Presses; Send for new First Facts, containing complete illustrated inventory; First Machinery Corp., 209 Tenth St., Bklyn. 15, N.Y. Fred R. Firstenberg, Pres.

LIQUIDATION SALE: molding plant: (2)—325 ton French Oil compression presses. (1)—300 ton Erie compression press. (1)—170 ton transfer press. (1) —100 ton compression press. (3)—75 ton transfer presses. (1)—No. 5½ T Colton preform machine. (1)—3 DT Colton tablet machine. Reply Box 5003, Modern Plastics.

FOR SALE: 2 oz. Van Dorn semi auto. 4 oz. Lewis, 1954—$3,000. 4/6 oz. R-P, 1955. 4 oz. vert. DeMattia. 8 oz. R-P, 1946—$5,000. 12 oz. W-S Model E—$6,000. 12 oz. Lester w/solid frame—$4,000. 16 oz. vert. Impco. 48 oz. W-S 1950. Two head bottle blowing machines. Ovens, grinders, powder mixers, injection molding machines 1 oz. to 60 ozs. never used and used. Acme Machinery & Mfg. Co., Inc. 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900. 102 Grove Street, Worcester, Mass. PLeasant 7-7747. 5222 W. North Ave., Chicago, Illinois, TUxedo 9-1328.

JUST SECURED: Most Modern Packaging And Processing Machinery, available at great savings—4—Hayssen model F compaks with net weight scales, bulk and dribble feeds, electric eyes. 4—Ceco model 40-9½-GG automatic adjustable cartoning units. Also model TT. Package Machinery, Hayssen, Scandia, Wrap King, Miller Wrappers. 1—Pneumatic scale automatic carton feeder, Bottom Sealer and Top Sealer with interconnecting conveyors. 6—Fitzpatrick model D-6 stainless steel comminuters. Day, Robinson 50 to 10,000 lb. dry powder mixers. Baker Perkins, from 2 to 100 gal., double arm mixers, jacketed and stainless steel. Stokes DD2 and Eureka tablet machines. Complete details and quotations promptly submitted. Union Standard Equipment Company, 312-322 Lafayette Street, New York 12, N.Y. Phone: Canal 6-5334.

FOR SALE: H. P. M. 16-OZ. Injection Molder Late—350-ton & 20" stroke clamping—90-ton & 12" stroke injection—28½x 31" platens—30-HP. 250-ton Upmoving Hydraulic Press, $995. Plastic Scrap Cutters—all sizes. Oilgear and Lourie Hydraulic Preses. Hydraulic and Vacuum Pumps. Vacuum Impregnator. Hydaulic Test Bench. Machinery Bought and Sold. Abbott Machinery Company, 117-123 Peter Street, Union City, New Jersey. UNion 5-1700.

(Continued on page 374)

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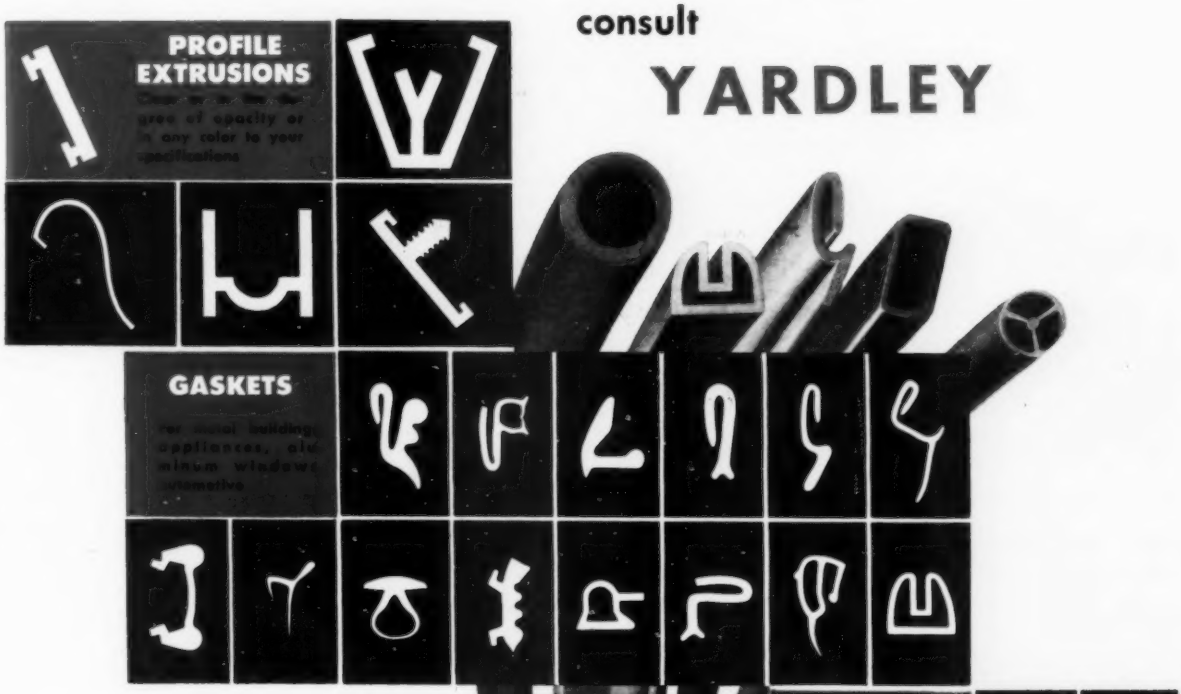

What do you need . . . in production quantities? Yardley extrudes any shape in a variety of formulations to meet a wide range of design and performance requirements. Our engineers have developed advanced techniques that can save you time and money on exactly the right shape for your specific needs. If you require extruded plastics of consistent, uniform accuracy — or fabricated extruded parts — Yardley diversity and capacity are worth looking into.

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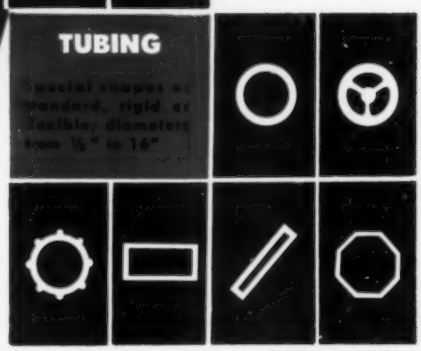
Our complete tool and die shop is staffed with skilled technicians. In addition, we maintain a library of over 300 section dies, one of which may fit your product design.



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I am interested in learning how you can help us find better ways to solve our extruded plastics problems.

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Company_____

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Position_____

YARDLEY PLASTICS CO.
142 PARSONS AVE., COLUMBUS 15, OHIO

(Continued from page 372)

Machinery wanted

WANTED: Good 2 to 3 ounce injection machine and accessories. We will pay cash. Reply Box 5010, Modern Plastics.

WANTED TO BUY: Used injection molding machines, oven, granulators. One machine or complete plant. Acme Machinery & Mfg. Co. Inc., 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900, 102 Grove Street, Worcester, Mass., PLeasant 7-7747, 5222 West North St., Chicago, Illinois, TUxedo 9-1328.

WANTED: 32 oz. or larger injection moulding machine—Reed Prentice, H.P.M., Leicester. State age, condition and full particulars. Reply Box 5005, Modern Plastics.

WANTED: Used injection molding machines, extruders, plastics processing equipment. From one machine to a complete plant. We can also assist you in selling company. Zimmerman Machinery Co., 46 Easton Road, Westport, Conn., CApital 7-0472.

Materials for sale

FOR SALE: 30,000 lbs. virgin natural medium impact styrene. 20,000 lbs. virgin pastel shades hi impact styrene. 25,000 lbs. virgin natural polyethylene. Also standard toy colors polyethylene. Low prices. Reply Box 5002, Modern Plastics.

Materials wanted

MATERIALS WANTED: Surplus quantities of black polyethylene, water pipe extrusion grade, for export to Germany. Reply Box 5011, Modern Plastics.

PLASTIC SCRAP: all types and grades purchases, large and small quantities. Top prices. Send description, and small representative sample to: Success Plastics Corporation, P. O. Box 506, Indianapolis, Indiana. LIberty 6-2919.

ESTABLISHED AGENCY WANTS LINES: Wants complete line of cements and adhesives for Up-State New York. 18 years experience selling and servicing bonding mediums. Calling on all industries using such products. Would also be interested in obtaining other lines, for industries such as Furniture, Camera, Automotive, Shoes, Electric Products, Rubber Goods, Paper Mills, Rigid Laminators, Honeycomb Constructors, etc. Reply Box 5012, Modern Plastics.

STYRENE WANTED: Need large quantities of reground or offgrade virgin general purpose styrene in Crystal, transparents, and standard colored white, red, green, yellow, or blue. Guaranteed highest prices paid. The Cane Co., Box 352, Highland Park, Ill.

WANTED: Butyrate (Kodapak II) Scrap And Blister Pack Trim. Also Polyethylene, Acetate and other types of Plastic Scrap. Claude P. Bamberger, Inc., One Mount Vernon Street, Ridgefield Park, N. J. Telephone HUbbard 9-5330.

WANTED: Plastic of all kinds—virgin, reground, lumps, sheet and reject parts. Highest prices paid for styrene, polyethylene, acetate, nylon, vinyl, etc. We can also supply virgin & reground materials at tremendous savings. Address your inquiries to: Gold-Mark Plastics Compounds, Inc., 4-05 26th Ave., Long Island City 2, N. Y. RAvenswood 1-0880.

BADLY NEEDED: High impact styrene—straight colors as well as mixed colors. We purchase all other types of thermo plastics in any form. For highest prices write, wire or phone collect. Philip Shuman & Sons, 15-33 Goethe Street, Buffalo 6, New York, Tel.: HUmboldt 1811.

Molds for sale

FOR SALE: 4 cavity plastic mold for suction cup soap dish, also rubber mold for suction cups, small inventory. Ready to run. T. F. Krumm, 5150 Lewis Avenue, Toledo 12, Ohio.

FOR SALE: Houseware molds, comb molds, also some novelty and specialty items. All in excellent condition. No reasonable offer refused. Send for list. Reply Box 5001, Modern Plastics.

Molds wanted

MOLDS WANTED: Want multi cavity molds for picnic forks, knives approx. 5", spoon approx. 7½"; also containers such as ½ gal., quart, etc. To run on 4-6 oz. Impcos, single or twin nozzle. Send complete information and prices. Reply Box 5013, Modern Plastics.

ANNOUNCEMENT: Mexican injection moulder wants to buy or rent injection used moulds suitable to four, eight or ten oz.—R. Prentice to make toys, combs, novelties and premium items. Ask Mr. Cavazos, Hilton Hotel, Chicago, from November 17 to 21, or write direct factory. P. O. Box 346, Monterrey, Mexico.

WANTED: Injection molds for watch boxes (hinged), also ring boxes. State price, technical data and enclose samples. Reply Box 5006, Modern Plastics.

SPECIALS: Reed Prentice 16 oz. injection molding machine; complete with Wheelco Controls. Vertical Watson Stillman injection molder 4 oz. capacity; for instant molding. Scrap Cutters Ball & Jewell #½ #1 and #2 complete with motor drives. Extra Blades & Screens Available. EXTRUDERS: MPM 4½" Elec. Htd. 40 H.P. Vari-drive Unused 1953. UNUSED JMC EXTRUDERS: 1½" to 6" sizes. 21 to 1 Barrel Ratio. Write for Catalog. MOLDING PRESSES: All sizes from lab to 2500 ton. Multi-opening laminating presses. Transfer molding presses. We solicit your inquiries. Johnson Machinery Co., 679-P Frelinghuysen Ave., Newark, N. J. BI-8-2500.

FOR SALE: 4 compression molding presses 470, 200, 150 tons; 3 Stokes preform presses model 294, R and F; 4 jacketed double arm mixers 25, 75, 100 and 200 gallons; 3 Cumberland ½ granulators, 3 HP; 1 NRM 2½" oil heated plastics extruder; also choppers, mills, mixers, etc., Chemical & Process Machinery Corp., 52 9th St., Brooklyn 15, N. Y. Phone HY 9-7200.

Help wanted

PLASTICS ACCOUNT EXECUTIVE: for large stabilizer manufacturer located in the East. Will be responsible for major accounts and prospects through agents. Must have chemical degree and experience in selling plastics industry. Position offers excellent opportunity and outstanding growth potential. All fringe benefits. Supply complete resume together with salary requirements. Prefer age between 35 and 45. Replies will be kept in strictest confidence. Advance Solvents & Chemical Div., Carlisle Chemical Works, New Brunswick, New Jersey.

HELP WANTED: Combination Production and Salesman of plastisol, solvent, emulsion coated, printed, laminated films, paper, fabrics. Have 72" unit with desire to expand. Be top man in new department. Let's talk. Send resume. Continental Chemical Co., Cayce, S. C.

ASSISTANT CHIEF ENGINEER: Graduate engineer with minimum of three years plant maintenance and engineering experience. Excellent opportunity in film extrusion plant—New Jersey metropolitan area. Send resume showing past earnings and present salary requirements. Reply Box 5019, Modern Plastics.

PLASTIC EXTRUSION: West Coast 5-Machine Plant. Technical man thoroughly experienced in extrusion techniques of all thermoplastics. Must know die design, setups and production, as well as handle personnel, to take complete charge of plant. Salary plus percentage. State experience in detail to Post Office Box 65951, Los Angeles, California.

SALES OPPORTUNITY: If you are a broker, consultant, or free-lance salesman we can utilize your services. A well-rated company new in the field of refining, buying and selling distress and surplus lots of chemicals, solvents, pigments, plastics, resins, by-products, and oils, needs assistance in establishing sales outlets and sources of supply in the east, midwest, and southwest areas. Liberal participation on a profit sharing basis offered with no financial investment on your part. Inquiries will be handled in strict confidence and will only be seen by our top executive. Reply Box 5015, Modern Plastics.

HELP WANTED: Polyvinyl Chloride Technical Service Wire and Cable. Excellent opportunity for experienced man to conduct Technical Service in PVC for Electrical Industry. Duties involve field calls as well as guidance of laboratory group. Permanent, responsible position with fast-growing national company. Pleasant New England location, 43 miles from Boston. Reply in confidence to: Borden Chemical Co., 60 Elm Hill Ave., Leominster, Mass.

HELP WANTED: Polyvinyl Chloride Product Development and Technical Sales Service. Background in P.V.C. Compounding in Rigid and Electricals—specifically desired. This opportunity is with a major long established P.V.C. resin producer whose laboratories are located in suburban New England. Please submit all details in first letter. Reply Box 5017, Modern Plastics.

(Continued on page 376)

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Single cans	$ 2.00
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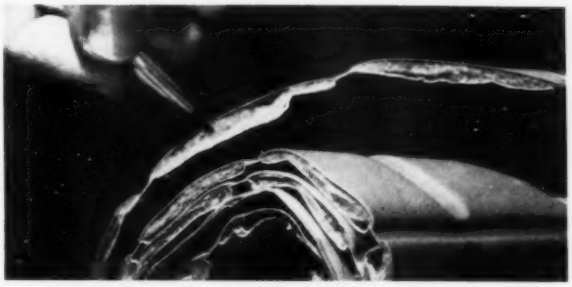
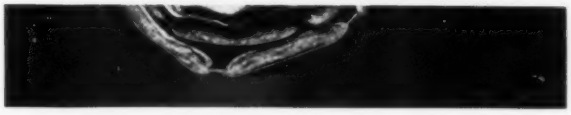


FELTERS ALLFAB



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(Continued from page 374)

MANUFACTURERS' REPRESENTATIVE: Well-known manufacturer of injection molding machines seeking top flight sales organization for representation on West Coast. We are a well established United States firm, long engaged in the manufacture of heavy equipment. Reply Box 5016, Modern Plastics.

PLASTICS ENGINEER: Progressive Southern California custom molder has opening for a young man as assistant to the chief engineer. The man we seek must have a thorough knowledge of plastic molding, including compression and injection, tooling, tool design, and fabricating, together with minimum of five years recent experience in plastics engineering. College background preferred. Reply with snapshot and resume. Reply Box 5018, Modern Plastics.

TECHNICAL DIRECTOR: Leading polyethylene film extruder has important position for capable director of development and quality control. Must have engineering degree and industrial background in plastics industry. Fast growing company in fast growing industry. Submit resume showing past earnings and present salary requirements. Reply Box 5020, Modern Plastics.

WANTED: Creative Thermo-Forming Engineer. To set up a new division. Will be reponsible for purchasing or creating production equipment. Knowledge of extrusion essential. Excellent opportunity for progressive thinker who values automation. Salary commensurate with ability. Send complete resume stating age, education and full description of experience. Reply Box 5014, Modern Plastics.

CHEMIST-GROUP LEADER: National food company located in Chicago suburb has challenging opening for experienced chemist to conduct research & development work on adhesives, coatings, lacquers, inks & solvents for cellophane, polyethylene, paper & foil. Should have 3 to 5 years pilot plant experience plus laboratory training. Some traveling required. Salary open. Reply Box 5022, Modern Plastics.

PLANT MANAGER: Polyethylene film extruder has opening for capable man to take complete charge of medium size plant in Chicago area. Must have broad background in similar field. Prefer engineer. Terrific opportunity for highly qualified man. Reply Box 5021, Modern Plastics.

HELP WANTED: East Coast Plastics Manufacturer has opening for a fully experienced plant manager, who has a successful record in the operating of extruding, vacuum molding and injection molding machines. Also an excellent opportunity to gradually obtain an interest in our Corporation. State your experience in your application or resume. Reply Box 5024, Modern Plastics.

SALES REPRESENTATION WANTED: Leading Chicago injection and compression Plastic Molder wishes to expand—increased sales a must! All territories open including local. John Mack & Son Company, 6227 N. Broadway, Chicago 40, Illinois. Ambassador 2-2525.

DEVELOPMENT ENGINEER: Must have degree in chemical engineering and at least five years practical experience in polyester glass laminates and molded parts for electrical industry. Rapidly growing company in middle West. Please send resume of your experience and salary requirements. Reply Box 5023, Modern Plastics.

VINYL EXTRUSION FOREMAN: Experienced in profile & sheet extrusion, must be familiar with machine set-up & die design. Only those well qualified in P.V.C. extrusion need apply. Location in B'klyn, N.Y. All replies held in strictest confidence. Reply Box 5007, Modern Plastics.

WANTED: Chemist or Production man experienced in the manufacture and development of Urea and Melamine-Formaldehyde resins for coatings and molding powders. The man we want must be capable of producing and selling these products to the paint and plastics industry. Excellent opportunity for the right man on a profit sharing plan. Location metropolitan New York. Full information in strictest confidence. Reply Box 5004, Modern Plastics.

PERSONNEL: Executive—Technical—Sale—Production. Employers and Applicants—whatever your requirements, choose the Leader in Personnel Placement. Cadillac Associates, Inc., Clem Easly—Consultant to Plastics Industry, 220 South State, Chicago 4, Ill.—WAbash 2-4800. Call, write or wire—in confidence.

Situations wanted

SALES ENGINEER: Capable, Aggressive—presently selling compression molding and preform equipment with particular experience in hydraulics and cycle control. Previous background includes sales management, project engineering, sales promotion, and general management. Will relocate. Prefer New England or Midwest. Reply Box 5033, Modern Plastics.

CHEMICAL ENGINEER: Age 30. Desirous of obtaining position in development or technical service. B. S. in Chemical Engineering. Background in reenforced plastics and plastic paper combinations, with supervisory training and experience. Resume and references on request. Reply Box 5025, Modern Plastics.

MANUFACTURERS' REPRESENTATIVE: Have over 8 years' experience handling plastics accounts in Washington, D. C. area. Both government and industry. Opening available for one additional substantial account. Reply Box 5026, Modern Plastics.

WANTED: We are active in the fields of Raw materials, Manufacturing machines, Testing equipment for the plastics industry and would like to represent USA manufacturer in Germany. Location Hamburg, excellent connections, technical service. Reply Box 5027, Modern Plastics.

Miscellaneous

BUY OR SWAP: Interested in toy molds for injection molding. Reply Box 5028, Modern Plastics.

HIGH MOULD COSTS?: Long delivery-times? Send us your inquiries and find out for yourself, that you can save up to 50% in money and time. Excellent international references available. Union Dies & Tools (Pty) Ltd.—Box 1766—Cape Town, South Africa.

WANTED TO BUY: Injection Molding Plant for Expansion Program. Must be located in New York, New Jersey, Connecticut or Eastern Pennsylvania. We are interested in operating this plant with its present personnel. Capacity up to 40 machines or as small as 10 machines, with land or buildings for expansion. Tax loss desirable. Reply Box 5029, Modern Plastics.

EXPANSION PROGRAM: Plastic Chemical jobber will merge, affiliate with, or purchase a plastic scrap processor or jobber. Confidential. Reply Box 5030, Modern Plastics.

QUALIFIED PLASTIC SALES ORGANIZATION: Desires allied lines of custom and proprietary plastics for Indiana, Illinois, and Wisconsin. Manufacturing concerns and distributors covered by experienced plastics salesmen. Protected territory only. Reply Box 5031, Modern Plastics.

MERGER OR PURCHASE: Injection Molding Plant with machines to 12-oz. capacity. Tax loss desirable. Forward details of equipment and tax status. Reply Box 5008, Modern Plastics.

EUROPEAN COMMON MARKET: Europ. injection-moulder with sales-organ. in main Europ. countr. is willing to tie in with U.S.A. firm, trying to get foot-hold in that market. Avail. for interview in U.S.A. in November. Reply Box 5032, Modern Plastics.

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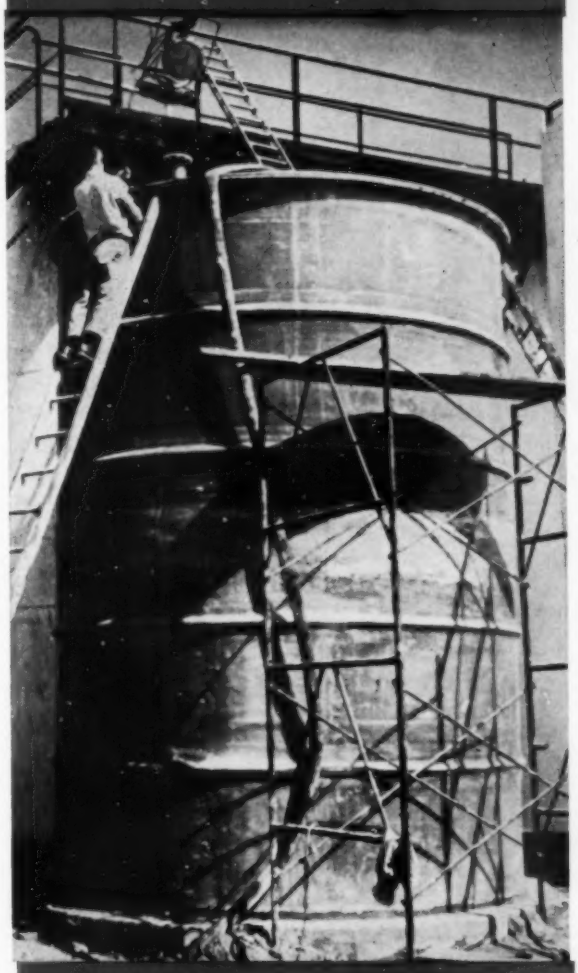

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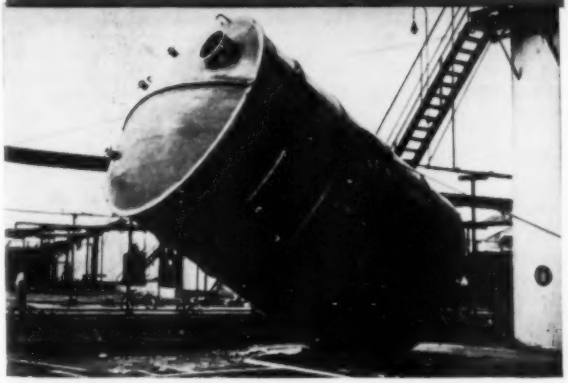

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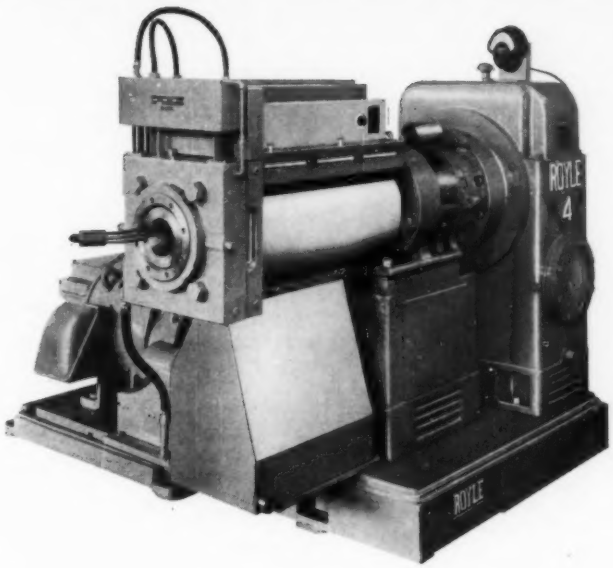

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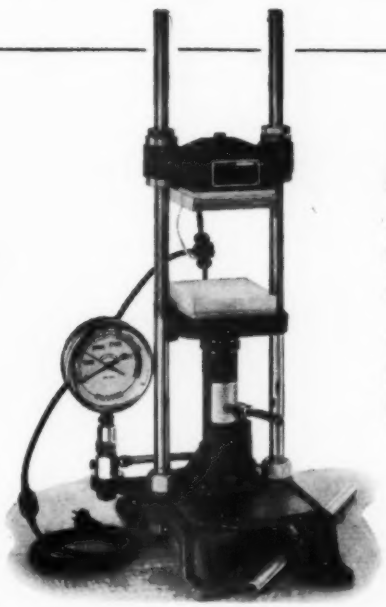

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Antimony Trioxide	—	12.5
Luperco ATC	2.0	2.0
Colored Pigment	as required	
3-oz Glass Mat	60.0	60.0
Flexural Strength psi, Dry 1	26,000	27,500
Flexural Strength psi, Wet 2	24,000	25,000
Tensile Strength psi, Dry 3	15,000	15,700
Tensile Strength psi, Wet	14,000	14,300
Flame-Out Time, Seconds 4	Burns	1

METHODS OF TESTING

1. Flexural Strength — ASTM-D650-42T
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3. Tensile Strength — ASTM-D638-46T
4. Flammability Test — ASTM-D635-44 — Test specimen 1″ x 6″ x 3/32″ is suspended horizontally at 45 degree angle so that 1″ of the specimen is exposed in a 5″ (1-1/2″ blue core) flame from a Bunsen burner. The sample is exposed 30 seconds and then the flame is removed. To be classed flame resistant the sample must be self extinguishing in less than 20 seconds.

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